THE

JOURNAL

OF THE

ROYAL AGRICULTURAL SOCIETY

OF ENGLAND.

VOLUME THE TENTH.

PRACTICE WITH SCIENCE.

LONDON:
JOHN MURRAY, ALBEMARLE STREET.
1849.

> THESE EXPERIMENTS, IT IS TRUE, ARE NOT EASY; STILL THEY ARE IN THE POWER OF EVERY THINKING HUSBANDMAN. HE WHO ACCOMPLISHES BUT ONE, OF HOWEVER LIMITED APPLICATION, AND TAKES CARE TO REPORT IT FAITHFULLY, ADVANCES THE SCIENCE, AND, CONSEQUENTLY, THE PRACTICE OF AGRICULTURE, AND ACQUIRES THEREBY A RIGHT TO THE GRATITUDE OF HIS FELLOWS, AND OF THOSE WHO COME AFTER. TO MAKE MANY SUCH IS BEYOND THE POWER OF MOST INDIVIDUALS, AND CANNOT BE EXPECTED. THE FIRST CARE OF ALL SOCIETIES FORMED FOR THE IMPROVEMENT OF OUR SCIENCE SHOULD BE TO PREPARE THE FORMS OF SUCH EXPERIMENTS, AND TO DISTRIBUTE THE EXECUTION OF THESE AMONG THEIR MEMBERS.
>
> VON THAER, *Principles of Agriculture.*

London: Printed by WILLIAM CLOWES and SONS, Stamford Street.

CONTENTS OF VOL. X.

APPENDIX.

PLATES.

DIRECTIONS TO BINDER.

The Binder is desired to place all the Appendix matter, with Roman numeral folios, at the *end* of the Journal, excepting Titles and Contents, which are in all cases to be placed at the *beginning* of the Part or Volume.

JOURNAL

OF THE

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

I.—*Farming of Lancashire.* By William James Garnett.

Prize Report.

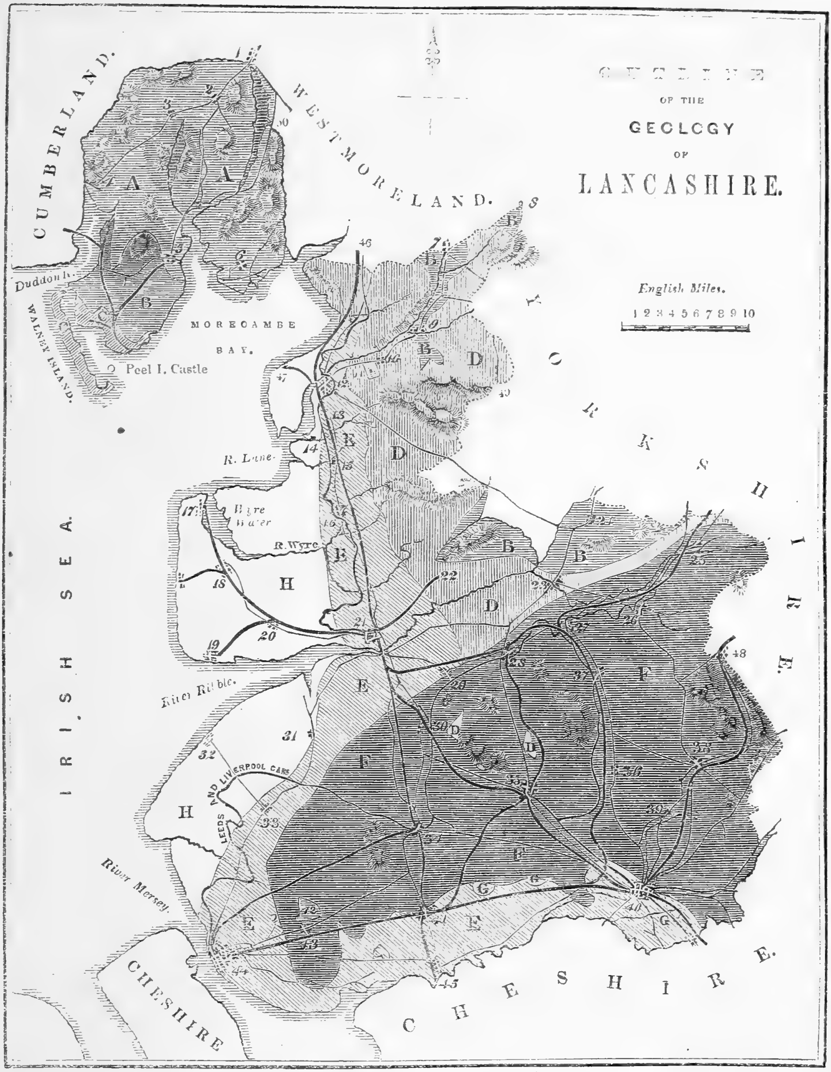
The county of Lancaster is a very important and a very influential one; but most assuredly its importance and influence do not arise from the excellence of its farming: whatever may be our character for skill in manufactures or success in commerce, we are sadly behind the rest of the world in agricultural attainments, and any traveller along the North-Western Railway, from the time of his entering, by crossing the Mersey near Warrington, to the time of his quitting Lancashire for Westmoreland, must, I fear, leave it with the impression that he has been passing through an ill-drained, badly cultivated, and neglected district. The northern part is decidedly better than the southern, but he would judge of it as a whole; and if, in the rapidity of his flight, his eye should perchance have rested for a moment on a good field of turnips or a clean stubble, a straight fence or a neatly-cut hedge, the oasis in the desert is so small, and the vision so fleeting, that it would have little effect in altering—or even, from the contrast with its neighbours, might rather tend to confirm—his opinion that the standard of farming in Lancashire is far below that of more southern counties he may have traversed in his journey.

Now, however simple and easy a matter it may be to observe the fact, it is by no means easy at first sight to assign the reasons for this state of things. If he consider the great wealth and intelligence which undoubtedly are found amongst a large portion of the inhabitants of Lancashire, he might reasonably expect something better in the way of farming; and before I proceed to enter into the subject-matter of this report, I would venture briefly to advert to a few of the causes which may excuse, in some measure, the defects and short-comings of my native county.

And first, let us look at the map of Lancashire. I propose to divide it into three parts; *the Southern, Middle,* and *Northern Divisions,* of which the three principal rivers of the county, the Mersey, the Ribble, and the Lune shall be the boundaries. The Mersey forms the natural boundary to the south, between Lancashire and Cheshire: the land lying between this river and the Ribble, which runs by Preston, I would call *the Southern Division,* or No. 1. The tract of country from the Ribble to the Lune, I would call *the Middle Division,* or No. 2, which includes the whole of that peculiar and interesting district known as *the Fylde;* and from the river Lune, which flows by Lancaster, to the northern boundary, which separates Lancashire from Westmoreland and Cumberland, I would call *the Northern Division,* or No. 3. Each of these great divisions is essentially different from the others in important points, such as the character of the soil, the climate, and the people, and I therefore would make this new division, rather than adopt either the ancient boundaries of the Hundreds or the Parliamentary Divisions, inasmuch as neither of the latter are marked by any great natural features, nor are they suggestive of any striking diversity in the soil or the inhabitants, and would not convey to the general reader any distinct idea of the districts as they are successively brought under his consideration; whereas, if we take the three great rivers and divide the county by these nearly parallel lines, a moment's glance at the map will show to any one the part then treated of.

The difference between the Southern Division, and the two others to the north of it, in its geology, in the nature of its soil, and the character and habits of the people, is most striking, and exercises a very important influence on the farming of the whole county. Its wealth, position, and extent deserve the first place in considering the causes of the past and present state of farming in Lancashire.

In the Southern Division lie the great *coal-fields;* these have led to the extraordinary development of the cotton manufacture and all its consequences, and have created a market for labour and skill far beyond anything the farmer could offer, and the consequence has been that all who were anxious to "get on" in the world, to make their fortunes rapidly, to gain large profits and quick returns on small investments, or who, tempted by high wages and the prospect of regular work, were not content to plod away their lives at the plough's tail, have been drawn into the great vortex of trade, and now people the large towns of Liverpool, Manchester, Bolton, &c.; and whether it be from the constant and active intercourse between man and man, or the greater exercise of skill and ingenuity, and the high premiums offered for clever artisans in the towns, or from whatever cause it be, I fear it must be admitted that the inhabitants of the towns



ARRANGEMENT OF THE STRATA.

A. Clay Slate.
B. Mountain Limestone.
C. Old Red Sandstone.
D. Millstone Grit.
E. Red Sandstone.
F. Coal.
G. Magnesian Limestone.
H. Alluvial Grounds.

REFERENCES TO NUMBERS ON THE MAP.

1. Ambleside.
2. Hawkshead.
3. Coniston.
4. Broughton.
5. Ulverston.
6. Cartmell.
7. Kirkby Lonsdale.
8. County Stone.
9. Hornby.
10. Caton.
11. Quernmoor Park.
12. Lancaster.
13. Scotforth.
14. Glasson
15. Galgate.
16. Garstang.
17. Fleetwood.
18. Poulton.
19. Lytham.
20. Kirkham.
21. Preston.
22. Longridge.
23. Clitheroe.
24. Whalley.
25. Colne.
26. Burnley.
27. Accrington.
28. Blackburn.
29. Hoghton.
30. Chorley.
31. Rufford.
32. Southport.
33. Ormskirk.
34. Wigan.
35. Bolton.
36. Bury.
37. Haslingden.
38. Rochdale.
39. Middleton.
40. Manchester.
41. Newton.
42. Knowsley.
43. Prescot.
44. Liverpool.
45. Warrington.
46. Burton.
47. Poulton.
48. Todmorden.
49. Raven Castle.
50. Windermere.

greatly exceed in acuteness and intelligence their fellows in the country districts: thus the capital, skill, and enterprise of the county being attracted to the towns, the rural districts have been comparatively deserted and left to those happy men who, content to live and die as their fathers had done before them, did not aspire to anything beyond, even in their own business of farming.

The climate of Lancashire is another counteracting cause; it varies according to the different districts: in the hilly regions to the north and east, it is of course cold and piercing, but in the lower parts, shelving to the south and west, it is generally mild and genial; but throughout the whole of it the fall of rain is far greater than in the south of England. Mr. White, Secretary to the Liverpool and Manchester Agricultural Society, in his evidence last year before the Committee of the House of Commons on Tenant Right, speaking of South Lancashire and the neighbourhood of Warrington, says, "We have 36 inches of rain falling in the twelve months;" but in the more hilly parts of the county to the north, my own observations, taken from one of Crosley's patent rain-gauges, would place it higher than that. The average quantity per annum in London, and the counties abutting on Middlesex, is about 20 or 21 inches, whereas in Lancashire I should say it was more than 40 inches, just *double;* and though the air is for the most part naturally pure and salubrious, yet this great humidity is a serious obstacle with which the farmer has to contend; and unless his land be thoroughly drained, is an effectual barrier to success either in growing or harvesting his crops.

The soil again is not naturally good, that is to say, in its undrained state; it varies of course considerably, and large peat-mosses or bogs, such as Chat-moss in the southern, and Pilling, with others adjoining, in the Middle Division, are found throughout. Of these dreary wastes I shall speak more fully in their proper place; but naturally they are perfectly sterile, and require a large outlay to make them produce anything, except, perhaps, fuel, of which great quantities are consumed by the neighbouring farmers and cottiers. With these exceptions, throughout the whole Southern Division, the soil partakes more or less of a clayey loam, very productive, if well drained, but without this necessary preliminary, cold and difficult to work; and that it is not in its natural state favourable to vegetation is clearly evidenced by the miserable fences, together with the stunted and weather-beaten trees, which give a starved and bleak appearance, tend rather to show than hide "the nakedness of the land," and scarcely deserve the name of hedge-row timber. In the Middle and Northern Divisions the soil is more friable, and throughout *the Fylde* partakes more of the alluvial and peaty character; still, without draining, it is comparatively unprofitable.

In *the mining districts* the ground is in many parts completely honeycombed and burrowed like a rabbit-warren: the superincumbent weight of earth over these excavations will often sink, and the levels of the surface becoming quite changed, any drains that may have been laid there are at once destroyed, and the owner's trouble and capital altogether lost; this is very discouraging to a farmer, and an evil unknown in a purely agricultural district.

To these drawbacks, natural and artificial, may be added the consequence resulting from them, which is this:—That the men who have grown rich in those great marts of industry and commerce, Liverpool and Manchester, and other manufacturing towns of the county, when they seek a permanent investment for their property in land, frequently leave the county in which they have made all their money, and, unwilling in the autumn of their years to engage in new and untried undertakings, are led to seek in more southern counties a more genial climate, a more fertile soil, a higher class of farmers and farming, and a more tempting investment than Lancashire can offer. I do not deny that there are some commendable exceptions to this rule, but for the most part it is unhappily true, as our rushes and bogs abundantly testify.

I have thus attempted shortly to describe and account for the general aspect of the county, as it would appear to the eyes of a passing stranger, but though as a whole I believe the above description to be a true one, yet if we examine a little more closely, we shall find many cheering instances of progressive improvement, both in the case of large landed proprietors and the more humble occupiers of the lands of their fathers, which give good grounds to hope that there is a spirit at work which will soon change the face of the country and enable us to take our proper place amongst the farmers of England. The Earl of Derby, at Knowsley, Mr. Clifton, at Lytham, the late Mr. Ffarington, of Worden, whose untimely and premature end has left a blank at Leyland which can never in this generation be filled up, Mr. Wilson Ffrance, in the Fylde, and the Duke of Hamilton, at Ashton, and others, have each in their several districts set a good example of what may be done by perseverance and skill, combined with a liberal and judicious outlay of capital: they have now left us without excuse: let each man, then, in his own sphere, and according to his means and ability, be "up and doing" in the great and good work of improving the land, by employing the people, and we shall then soon cease to be famous as the worst farmed county between London and Edinburgh.

The *geographical* situation of Lancashire is between 53° 20′ and 54° 25′ north latitude, and between 2° 0′ and 3° 17′ west longitude; it is bounded on the north by Cumberland and Westmoreland, on the east by Yorkshire, on the south by Cheshire and Derbyshire, and on the west by the Irish Sea. The extreme length is 74 miles, and its greatest breadth 44½ miles: its surface contains 1765 square miles, of which about 1125 are comprehended in the Southern Division, and 650 in the two other divisions. The area of the county comprises, according to the Ordnance Survey, 1,117,260 acres of land, of which about 350,000 are in tillage, 450,000 in pasture, and the remainder in woodlands, moors, and mosses.

The *population* in 1821 amounted to 1,052,200, and according to the last Census in 1841 it had increased to 1,667,054, of which it may fairly be said that three-fourths are engaged in commerce and manufactures, or dependent upon them for their employment and support; this allows 416,763 for the cultivation of the land.

The *great geological* features of the county consist in a chain of hills which separate Lancashire from Yorkshire on the east, and which run northwards from Ashton-under-Lyne, near Manchester, to Hornby. This tract of mountainous moorland is chiefly composed of millstone-grit and hard freestone formations, the soil for the most part being thin and poor, and in the lower parts a strong clay. Amongst the highest hills of the range are Blackstone Edge, Pendle Hill, which is 1805 feet above the level of the sea, and the Fells of Bleasdale and Wyresdale. The district north of the river Lune from Lancaster has the metalliferous limestone for its immediate substratum; and as we approach the northern mountains of the county, which form the barrier between it and Westmoreland and Cumberland, the transition limestone and slate prevail. These hills, from their picturesque beauty and height, form some of the most magnificent features of the lake scenery in this part of England; Coniston Fell, the highest point of which is well known by visitors to the lakes as the "Old Man," being 2580 feet above the level of the sea. The soil on this northern range is better than on the eastern chain, and the natural drainage more rapid and complete than on the grit formations. On the western and southern sides of the county is found the new red-sandstone, which forms an irregular band of some miles in breadth, extending along the vale of the Mersey, east of Manchester, to Liverpool, and thence along the western side by Ormskirk and Preston to Lancaster, and in this stratum is found the red marl, which is so valuable as a manure in reclaiming dry, sandy, and peaty soils; to the westward of this line lie the alluvial districts, and the coal-beds occupy the whole space between the red-sandstone and the eastern boundary of the county south of the Ribble.

Westward from the eastern chain of hills flow the three great rivers of the county, which with their numerous tributaries empty themselves into the Irish Sea. In the lowlands and valleys watered by these streams are found many parts favourable to a high state of farming, and we will now proceed to consider in order the three great divisions formed by these rivers with reference to the subject of this report, commencing with

The Southern Division.—(No. 1.)

The soil throughout the whole tract of country between the Mersey and the Ribble, and between the sea-coast and the first rising of the high hills to the east, is in general of a stiffish loamy kind, always excepting Chat-moss and its kindred wastes. Towards the sea-coast, to the west of the old high road from Liverpool to Preston by Ormskirk, there is a district of great fertility, being for the most part of a sandy vegetable loam of considerable depth; and Mr. White, to whose evidence we have already referred in speaking of the general character of the South Lancashire land, says, "About two-thirds of it is strong clayey loam, upon a subsoil of clay; the clay requires under-draining before it can be properly cultivated." Throughout the whole of the lower districts of this Division all sorts of grain are occasionally grown, but oats and wheat are the most prevalent, yet barley is frequently met with near the coast; potatoes are cultivated largely in the neighbourhood of Ormskirk and Warrington, whence great quantities are taken to supply the Liverpool and Manchester markets; and it is a fact in husbandry worthy of remark, that the first potatoes raised in England were grown in this county.

Turnips and the artificial green crops have been introduced within the last few years, and continue to be grown with increasing success; but as yet a regular and scientific system of cropping is rarely met with. Around the large towns the grass-land is mostly preserved undisturbed, and the produce in milk and butter daily conveyed to supply their never-failing wants.

The only limestone found in this Division lies in the extreme north-eastern corner, in the neighbourhood of Clitheroe: it is, in fact, the western side of the Craven bed, which here runs into Lancashire from Yorkshire, and will become most valuable to the whole of the Southern Division on the opening of the Blackburn, Clitheroe, and North-Western Railway, now in course of construction.

On the eastern and hilly side of this Division there is not much to interest a farmer: in the neighbourhood of Clitheroe and Whalley there is some excellent land, and the advantages of the limestone on which this district rests are sufficiently apparent both in the aspect of the country and the general produce of the farms: but from Whalley to Manchester, through Accrington, Haslingden, and Bury, and still farther to the east by Colne and Burnley, the land is mostly kept in pasture. This is altogether a coal district, and consequently a thickly peopled one; the farmers find a ready sale for their milk in the towns and villages, and hence there is little stimulus to exertion. Draining is more or less required throughout the whole; the soil is a cold tenacious clay, and the country has a bare and dreary appearance: the land, being divided into small properties and holdings, lets high; 2*l.*, 3*l.*, and 4*l.* per acre being a common rent. A population such as the whole of this is, employed in hand-loom weaving and mills, is not likely to advance much in agriculture; still there are instances of improvement by the owners of the soil. Sir Robert Peel has drained almost all his land, to the amount of 1000 acres, in the neighbourhood of Accrington, under the direction of Mr. Josiah Parkes, at a depth of 4 feet, and at various intervals, with 1½-inch pipe, tiles, and collars, which are made at an old-established pottery at Oswaldtwistle, close to his property; other tileries are about to be erected in this district, which will tend to improve the quality and lower the price of this necessary article.

On leaving the hilly districts and descending into the low country to the westward, the first important feature in an agricultural point of view is the cultivation of Chat-moss; this is a large bog or morass, situate about 7 miles to the westward of Manchester; it is 5 miles long from east to west, and about 3 miles broad from north to south, covering an area of about 6000 acres. The Liverpool and Manchester Railway passes through, or rather over it, from east to west. Much variety of opinion prevails as to the origin of these mosses; some carry their formation as far back as the general deluge, but the more probable theory is that they have been caused by the natural decay of primeval forests in the valleys or hollows, from which the water had no escape; a few trees blown down or felled would readily choke up the outlet of a small stream with little or no fall, and when decay had once begun its ravages in a forest so situated, it would proceed with an ever accelerated rapidity until the whole was reduced to a mass of decayed or decaying vegetable matter.

The surface of Chat-moss is a sort of long, coarse, sedgy grass and heath, tough enough to enable a man to walk upon it in most parts; but it was given in evidence by Mr. Giles before the Committee of the House of Commons, preparatory to the making of the Liverpool and Manchester Railway, that a boring-rod, when forced through the surface vegetation about the centre of the moss, would sink with its own weight to the depth of 34 feet. At that depth there was a vein of 4 or 6 inches of clay; below that 2 or 3 feet of quicksand; and at the bottom of all, hard clay which kept the water up. The same engineer gave it as his opinion that a railway could not with safety be made over Chat-moss without going to the bottom of it; but the late Mr. George Stephenson, with his usual engineering skill, preserved the surface untouched; and, by laying some brushwood and hurdles upon it to make a foundation, and opening side-drains, carried the railway in safety over the top of this mass of bog, which varies in its depth from 10 to 37 feet. The railway, in fact, *floats* upon the moss.

Few men would ever have dreamt of cultivating such a waste as Chat-moss; but Mr. Roscoe, of Liverpool, first commenced this great work by trying to drain 2000 acres; after a series of laborious and costly experiments, the chief fault of which was his desire to do too much, and to lay the open drains too deep and too far apart, he was compelled to give up the undertaking; and it was reserved for Mr. Reed, assisted with the capital of a company of gentlemen formed for the purpose, to accomplish the desired object.

This gentleman, in a very valuable Essay, which gained the premium at the Liverpool Agricultural Society's Meeting, September, 1833, and was subsequently published by that Society, has detailed the method he adopted to reclaim the moss, and to this day the abundant produce of the soil bears testimony to his complete triumph over its natural sterility.

The drainage was the first step to improvement; this was effected by cutting open parallel ditches 66 yards apart, 4 feet wide at the top, and sloping down to about 14 inches at the bottom, and 3 feet 6 inches deep: in a wet floating mass like this moss it was not possible to sink the ditch to the whole depth at once, and the first two spits being taken out it was then left for time to consolidate the surface; the covered cross-drains, 10 yards apart, laid 3 feet deep, and running into the open ditches, were commenced, but in forming these, as well as the open drains, it was necessary to allow some time to elapse between the different operations, that the water might to some extent run off; the hollow drain was made by the top sod, dried by exposure to the air, being wedged into the open cut, and the peat thrown in again upon that to fill up.

When the surface was partially dried, the heath and other plants growing upon it were set on fire and burnt off as closely as possible; and by ploughing and cross-ploughing, and cutting up the sods with a roller armed with knives, the ingenious contrivance of Mr. Reed, he was enabled to destroy the tough and elastic character of the surface: after this process marl, which was found at the southern edge of the moss, was, by means of a moveable railway, laid on the top, to the amount of 100 cubic yards to the statute acre; the average distance which the marl had to be removed being about two-thirds of a mile. Whilst these operations were in progress, I went over the moss with Mr. Reed, and remember that both men and horses were obliged to work with pattens, or flat pieces of wood, attached to the feet.

By means of the Liverpool and Manchester Railway, then in full operation, Mr. Reed was enabled to bring from the latter town any quantity of manure; and he found that a mixture of night-soil and ashes was preferable to anything else. By growing a crop of potatoes in the first instance, the different particles of moss-earth and manure became so thoroughly blended together that the soil formed would produce anything, and wheat, clover, and oats followed each other in successful rotation. Since Mr. Reed left, some years ago, the management has been intrusted to Mr. Evans, now of the Haigh Foundry, Wigan, and it has been discovered by experience that it is not advisable to grow wheat or clover on such land: turnips, oats, and potatoes are considered the best crops; and instead of marl, which is both bulky and heavy to move, it is now ascertained that salt mixed with lime is the most effective instrument in destroying the mossy nature of the surface, and preparing it for a first crop of potatoes; these grow exceedingly well on *moss-lands unmarled*, but if marled, their failure is as general as on other soils. In Professor Johnston's recent work 'On the Use of Lime in Agriculture,' it is stated, chap. xi., section v., that "The use of lime and salt has been frequently recommended by Mr. Cuthbert Johnson and others; and its virtues, in the proportion of one of salt to two or three of lime, have more lately been experimentally tested and recommended by Mr. Huxtable. It seems to be particularly adapted to deep soils, as they are called; to such as are covered with moss, and to reclaimed and drained peat-bogs."

There is still much of this moss in its natural state; but it is to be hoped that, lying as it does in the heart of a populous district, and traversed by a railway connecting together the two most important towns in the kingdom, it will not long continue so; and that, with the example of what may be done, Chat-moss will in a few years become a cultivated plain, administering to the wants of an ever increasing population.

To the north-east of Chat-moss, and on the high land overlooking the whole of the lower part of Lancashire and Cheshire, is Worsley, the property of the Earl of Ellesmere; within the last two years his Lordship has established a tilery, and drained a large portion of the Old Hall Farm with 2-inch pipes and collars, at 4 feet deep, and 10 yards apart. They seem to run well, but the land is stiff and heavy to work; it produces good crops of wheat, oats, and beans: last year the turnips did not succeed, their failure being attributed chiefly to the constant rain in the summer of 1848; but they have been grown 25 tons to the statute acre, whilst the wheat sown by drill averages about 4 quarters, and beans 40 bushels. The milch cows, in number 25, together with the young stock, is decidedly above the average, and the milk is immediately disposed of in supplying the neighbouring villages of the district.

Near Newton, half-way between Liverpool and Manchester, on the London and North-Western Railway, there is a farm which deserves a passing notice, the property of Mr. Bankes, of Winstanley Hall; it lies immediately to the eastward of the Newton Station, and on both sides of the railway, and is now in the occupation of Mr. Wilson. This gentleman was one of the first to set the example of draining in this part of the country, when living some years ago on a farm of Mr. Greenall's in Winwick. His present farm contains 250 statute acres, with a good house upon it; but the farm-buildings are old, and quite inadequate to the wants of the present day. When he came to it, about two years ago, he found the land in a wretched state; his first object was to get it all drained, and this he has nearly accomplished with horseshoe tiles and soles, which he obtains from a tilery close to Newton. The soil being a strong heavy loam, he has cut the drains 3 feet deep and 5 yards apart, but made no air-drain, and, with the help of some Irish workmen, he was enabled to do this at the cost of 4*d.* a rood of 8 yards, the tiles being laid by the day at 13*s.* per week; he has grubbed up the old irregular fences, and filled up the ditches, so as to divide the farm, where practicable, into fields of about 25 acres each, or more. His plan is to plough up the old rushy sward for oats; 2ndly, turnips, with farm-yard manure and guano; 3rdly, wheat or barley, with seeds to remain as pasture for two, three, or more years, according to the price of corn or other circumstances. The land being foul for the turnips, he cleaned them by hand-labour for five or six weeks, and succeeded in getting a crop of swedes, about 30 tons to the acre; in preparing the land for the turnips, he found the Norwegian harrow a most useful implement: he ploughs with a common iron plough and two horses, and sows for wheat 2 bushels to the statute acre. But he unfortunately lives under the shadow of a large chimney, more than 300 feet high, which is continually vomiting forth its pestilential breath from some extensive chemical-works in the neighbourhood, to the certain damage of all vegetable life within its range, and that this is not confined to a small extent may be judged from the withering effects visible upon the trees for miles round. The nuisance occasioned by these works has been so grievous and intolerable to the whole neighbourhood, that the farmers, with Mr. Wilson at their head, have taken the matter up, and are endeavouring to form a Society for the protection of their interests, and the removal of such works, which certainly are most objectionable in the midst of an agricultural district. It is to be hoped that by the united efforts of both the landowners and occupiers this evil will soon be entirely suppressed.

Proceeding westward, towards Liverpool, we come into the neighbourhood of Knowsley; the soil here becomes lighter, and, resting upon a substratum of new red-sandstone, is more forward and more easily worked than the cold clays of East Lancashire. One of the most interesting farms on the Earl of Derby's property in this part of the country is Halewood, comprising 300 statute acres, and now occupied by Mr. Robert Neilson: this gentleman, since he took the farm about 10 years ago, has spared no pains or expense to render it one of the most complete and perfect establishments in the country, nor is it merely as gratification of a personal feeling, or the indulgence of a temporary fancy, that the system which he has adopted is to be viewed; he has been trying to work out, as a matter of business and practical inquiry, an experiment in which all the landowners and farmers of Lancashire are more or less interested. Expensive implements have been purchased by him, and used on the farm; a fixed steam-engine of 6-horse power is constantly at work in the different operations of cutting hay and straw, crushing oats, cutting turnips, sawing wood, and steaming all kinds of provender for horses, cows, and pigs. A small railway or tramroad has been laid down in the yards for the purpose of carrying the food to the animals and conveying away the manure to the dungheap, whilst a considerable length of light moveable railway, an invention of Mr. Neilson's, is used in bringing the produce of the fields to the farm-yard—in wet weather and on level ground, a most valuable expedient. If Mr. Neilson has done this as a farmer, it is to be hoped that the farming community may some day or other be put in possession of the results, or at least may be informed whether the balance is on the debit or credit side of the account. All the farm is drained with horseshoe tiles and slate soles, the latter being the refuse of the Welsh quarries. I was informed by the farm bailiff, who kindly took me over the farm in the absence of Mr. Neilson, that pipes had been tried; but they do not answer in that neighbourhood, inasmuch as the crevices become choked up with a kind of weed or the roots of plants—consequently their use has been abandoned. The drains are laid at a depth of 2 ft. 6 in. or 3 ft. 6 in., and the mains, where there is fall, 4 ft., the space between the former being 7 or 9 yards. Wheat, oats, barley, beans, vetches, and turnips are all grown upon the farm; but potatoes have been given up. The course is as follows, with certain modifications according to particular circumstances:—

Wheat, by a broadcast machine on ribbed furrows, 6 to 8 pecks per acre.
,, if drilled, 2 ft. 6 in. apart, 4 to 5 pecks per acre.
Vetches, till June, and then transplanted with turnips.
Turnips and mangolds in drills 32 inches wide.
Beans, drilled.
Wheat or Barley.
Seeds for one year.

I was informed on the spot that one field of wheat, manured from the farm-yard, and sown by a broadcast machine on ribbed furrows, with a dressing of guano in the spring, produced last year 48 bushels to the statute acre, whereas that sown in drills 2 ft. 6 in. apart yielded from 32 to 36 bushels; I do not know whether or not this latter had any guano. A twenty-seven acre field of turnips also last year, after wheat, with farm-yard manure ploughed in with the stubble at the rate of 50 tons the acre, and afterwards 1½ cwt. of bones dissolved in sulphuric acid per acre, produced 40 tons of turnips to the acre; this was the first trial of bones with sulphuric acid, and the result most satisfactory. Both the drilled wheat and beans are sown by the same implement, which consists of a single box or covered barrow, fixed by an iron rod to the handle of a double mould-plough, at such a distance that the seed falls 1 ft. 3 in. from the furrow formed by the plough, which is drawn by two horses; one man of course holds the plough, and another the handles of the box, which runs on a wheel, and has a small spout through which the seed drops; the two men walk side by side, the box being kept in its place by the iron rod which fixes it to the plough, and this latter covers the seed, not of course as it is dropped, but in returning down the next furrow. I saw this simple machine, which is Mr. Neilson's own contrivance, at work sowing beans, and calculated that the two men and two horses would sow about 5 acres in a day. Mr. Neilson has standing room for 100 head of cattle, of which from 30 to 40 are milch cows, the milk being sent to Liverpool, about 6 miles distant; he employs a large number of men and women in gangs of from 60 to 100, in hoeing, cleaning, and reaping, so as to get through the work rapidly, and 14 horses.

The rotation of crops in use by the farmers of the neighbourhood of Halewood, was potatoes, wheat, turnips, and oats, with seeds or not; but the failure of the potatoes has obliged them to adopt in some cases beans as a substitute: they have no implements of any importance.

Throughout the whole of the Earl of Derby's estates in this part of the country, most of the farms have been held on life leases, and are in the hands of men who have no capital to lay out—and no knowledge or desire to improve. The evil consequences of this system are sufficiently apparent on the surface, and as any of the old leases drop, the farms are now generally re-let on terms of years, and for any outlay in draining by the landlord the tenant is charged 5 per cent. From Knowsley to Ormskirk the road passes through a tract of mosses, Rainford and others; a great part of this has been reclaimed by his lordship, and is about to be formed into a farm of 500 acres around the site of the old Mossborough Castle; the feudal remains have disappeared to make way for a new and substantial stone farmhouse, which, with the buildings proposed to be erected, will soon form an establishment more suited to the habits and wants of the present day; the plough-share and the pruning-hook have here literally taken the place of the sword and spear of ancient days.

At Bickerstaffe Hall, Mr. Smythies, a gentleman from Herefordshire, occupies a farm of 380 acres, which he farms on a six-course shift—potatoes, wheat, turnips, barley, and seeds for two years; the potatoes having for the most part proved a failing crop, he now proposes to begin with oats, then turnips, &c.: the old fences have been cleared away, and the fields made of proper form and size; his buildings are large, but not arranged on the best plan,—the old barn being retained, and part of the farmstead in its original form, they are not so perfect as an entirely new set would be. Most of the farm was drained before he came to it, at a depth of 2 ft. 6 in., and on his first proposing to deepen that to 3 ft. he met with little encouragement; now, however, both here and elsewhere on the Derby estates the three-feet system is adopted.

In walking over his young wheat and seeds with him, I observed that some four-footed friends from the adjoining covers had been rather busy at his expense;—in fact, winter vetches, one of the most valuable crops to a farmer, cannot be grown here.

Proceeding northwards, near Ormskirk, there is a farmer at Fairhurst, who, without a lease, merely a tenant from year to year, and occupying about 160 acres, spares no expense and pains in farming it on the best principles. The Earl of Derby, in approval and return for his exertions, has lately erected for him some new buildings (he carting the materials), which are quite deserving of notice as simple in their arrangement and well adapted to the means and wants of the practical farmer: the steaming and boiling-house is not yet built, but this will shortly be done; and when completed, the whole will form a quadrangle, with a straw-yard for pigs in the centre, paved at the bottom, and about 23 yards square, enclosed by flags set upright and fastened together with iron bolts; this excellent material for the purpose is got from quarries in that part of the country. Between the straw-yard and the buildings there is a space of 5 or 6 yards paved all round; the shippon and stables are well ventilated at the top. When I visited this farm, four horses were at work thrashing with a machine, which the tenant has put up at his own expense.

The soil throughout the whole of this district is loamy and tolerably easy to work; still farther to the westward it becomes gradually lighter, till in the neighbourhood of Formby and Southport it is almost all sand. In many fields at Formby, near the shore, there is soil two feet below the sand, that lies beneath the greensward: it would seem that this soil, which is about four inches thick, was originally the surface, and has been buried at some former period by sand-drifts.

Near Rufford we get into the mosses again; which, however, have in a great measure been reclaimed: large fields, intersected with open dykes and watercourses, produce good crops of potatoes and oats, or are now to a large extent laid down in permanent pastures and meadows.

The cart-horses throughout the whole of the western side of this division still preserve the character they bore in Mr. Dickson's time; the farmers take a pride in their teams, and as they were improving in his days they have continued to do so, till now it would be difficult to surpass them in any district of the kingdom.

Throughout the greater part of this division the manufacturing population predominates very much over the agricultural, and hence the tendency to small farms and holdings. The farmers as a class are inferior in position and education to those of other parts of the kingdom. The habit of taking two white crops in succession still prevails very generally amongst them, and the practice of laying down the land in narrow butts, often after wheat, and in many instances allowing it to grass itself over, cannot be too strongly condemned. The evils of the bad system which has prevailed for the last 50 years or more, are so manifold, and the prejudices of the people so deep-rooted, that it will take many years to eradicate them, and raise the agriculture of this part of the county to its proper position.

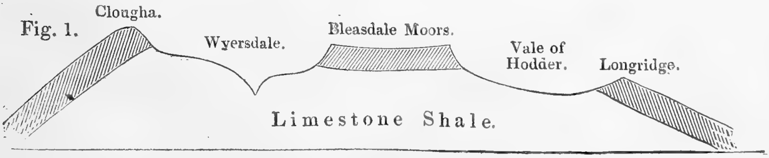
Middle Division. (No. 2.)

On crossing the Ribble to the north, and passing through Preston, we at once leave the manufacturing districts; they belong to the Southern Division, for, excepting Preston with a population of 50,000 souls, and Lancaster with 15,000, there is no town of importance between the rivers Ribble and Lune. Preston is of course a manufacturing place, and, being situated on the extreme southern verge of the Middle Division, may fairly be allowed to belong to the Southern; and Lancaster, though it has produced a few tall chimneys, cannot find in them much to be proud of, they are evidently exotics, they do not thrive as in the south, nor increase in number; coals are brought from a distance, and the old county town, with its ancient castle and quiet sombre-looking streets, cannot in the nineteenth century be classed amongst the busy and bustling scenes of manufacturing industry.

We are therefore now in a purely agricultural district; the whole appearance of the country is changed: the trees, no longer blackened and begrimed with the smoke, wear their natural colour; the air is pure and the sky clear; and the ruddy looks of the inhabitants plainly testify that they do not live in mills, nor pass the best of their days in driving the shuttle. Tall and strong of limb, and intelligent in countenance, there certainly is no physical hindrance to their being as good farmers as any in England.

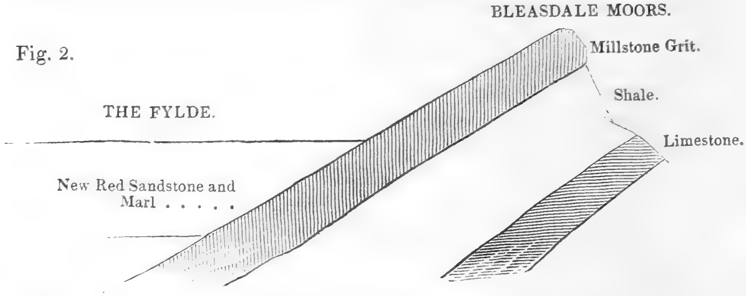
The soil of this division, on the eastern parts and mountainous slopes of Longridge, Bleasdale, and Wyresdale Fells is thin, and of a black moorish nature; the lower portions of the sides of the hills and the valleys formed by them are commonly somewhat of the nature of the holms, with brooks and rivulets running through them. At the foot of the hills and through the townships of Goosnargh, Barton, and Claughton, and for the most part along the line of the Preston and Lancaster Railway, the soil is of a stronger quality, in many parts amounting to a stiff clayey loam. The Fylde is that tract lying to the westward of the above-named railway, and bounded by the Ribble, the sea, and the Lune; in this low-lying country almost every kind of soil is found, from a stiff clay to sand or bog, but the greater part is clayey loam and alluvium, intersected in many parts with large and deep mosses, such as Pilling, Rawcliffe, Nateby, &c. To understand the nature of the soils of this division, and the geological relations of Clougha (the northern ridge of Wyersdale), Bleasdale Moors, and Longridge with each other and with the Fylde, the annexed sketches, taken from Professor Phillips' 'Report on the Vicinity of Lancashire,' may be of service; all the hills are capped by lower millstone grit, resting on the limestone shale; this section is made on a line drawn from north to south:—

Fig. 1.



This other section is made on a line drawn east and west:—

Fig. 2.



The only limestone fit for agricultural purposes found throughout the whole of this division is in the neighbourhood of Chipping, a village seven or eight miles north-east of Preston, in the valley which separates Longridge Fell from Bleasdale Moors; it is extensively used in these parts as a top-dressing to the grass-lands and sheep-pastures, and with good effect. The cost at the kiln is 11*d*. a windle, and two windles are equal to 3 cwt.

The *inhabitants* of the hills are a manly and independent, but rather uncultivated, race; shrewd enough as far as their own immediate interest is concerned, but incapable of looking forward; unwilling to lay out *sixpence* this year in the chance of receiving a *shilling* next, and jealous to an extreme of any alteration or innovation on the customs of their fathers. Many families have lived on the same farms for generations; and by frequent intermarriages they have become connected together almost like one family, and, with a strong attachment to their native hills, care little to receive or visit strangers.

Their farms are not large; some of the most important amount to 250 or 300 statute acres of enclosed land, with a large right of sheep-pasture over the moors adjoining, and held for the most part on yearly tenancies. The stock on the farm is generally all the capital they possess, which consists of a herd of milch-cows and their calves of different ages, little or no care being given as to the breeding of them; a flock of black-faced sheep of very inferior quality, and a pig or two, with perhaps a couple of horses when the farm is large, make up the total of their property: they generally keep their land in grass, with a plentiful crop of *rushes,* which serve, *as they say,* "to keep it warm;" or if they plough it up and take a crop of oats, which is the most they ever aspire to, they leave it to time and nature to grass it over again, and never think of *putting any manure on;* this is all preserved for the meadows, which are really of importance, inasmuch as they produce the hay which is to keep the stock through the winter. The hay-harvest is therefore the most critical time of the year, and they give it all the attention they are capable of. They mow with large scythes, 5 feet or 5 feet 6 inches long, very heavy, and therefore slow in action, and they shake out the swathe, not with forks or any implement, but with the hands. The climate being precarious and the population small, the hay-making on a moderately-sized farm takes a month or six weeks, part of July and August, and as it is made it is secured in close barns, not in stacks or open sheds: 2 tons to the acre is a good crop. The produce of the cows is made into cheese and butter, mostly the former, and the whey given to the young calves. They have no green-crops nor farmyards for turning the cattle into and preserving the manure during the winter. Simple and hardy in their habits, they have few wants beyond the actual necessaries of life; their houses are built of the rough gritstone of the country, and the turf on the moors adjoining serves the purpose of fuel. Wheaten bread is a rarity; and the bakestone, or hot hearth, for baking the large oatcakes upon, forms a necessary appendage to the farm-house and the cottage; in fact this is the case throughout the whole of North Lancashire. The oatcake is still the favourite food both of farmers and labourers.

Draining, wherever it has been attempted, has been done sometimes with sods, but more commonly with stones, the natural materials of the country: the drain is made in the form of a sough, with rough stones, at a depth in some cases of 28 inches, but for the most part not more than 18 or 20 inches, and carried across the fall at intervals of 9 or 12 yards, with just sufficient inclination to allow the water to flow, the object being to prevent thereby any scour of the subsoil. Some fill the drains half with the soil taken out and half with broken stones, and carry the latter up to the surface on the higher side of the drain, so that the surface-water may run into the drains as into a spout at the eaves of a house—a most effectual means, by the way, of carrying off all the small particles of manure, whether lime or anything else that may be lying there. This mode of draining costs 15*d.* per rood of 7 yards, but is gradually giving way to a better system; and the introduction of pipe-tiles enables the drains to be carried in safety down the fall at a greater depth and at less expense.

On descending the hills the style of farming begins to improve, and both the soil and climate admit of more attention being paid to arable culture, and with greater success than in the high lands. Still, with the exception of a few large landed proprietors, such as Mr. Brockholes, of Claughton Hall, and Mr. Jacson, of Barton, there is little improvement on the old system, and the dislike to alteration prevails here as elsewhere.

The fields in many parts for whole districts bear the appearance of having been ploughed till they could produce nothing, and the miserable herbage with long rows of rushes in the furrows show too plainly the great want of draining and management in the occupiers. Mr. Brockholes has, during the last twenty-eight years, since he came into possession of the property, drained upwards of 2000 acres, chiefly with stones and across the fall: many of the drains were at first laid out by himself so level that they have been choked up by the deposit of ferruginous matter, called *canker*, and require now to be done over again with tiles and on a better system. His soil is for the most part a stiff clay, and he does not approve of draining in such cases deeper than 3 feet. Being a constant resident, he is able annually to lay out large sums in improving his estate, and spares no pains in making it one of the finest in this part of the county.

On the property of Mr. Jacson, which lies between 4 and 7 miles north of Preston, a series of improvements was effected during the lifetime of his father, who will long be remembered in that district as a real benefactor in his generation, and his son continues to follow in his steps, endeavouring to recover a fine estate from the effects of former bad management. On a property of 2600 acres nearly thirty sets of farm-buildings have been rebuilt (at a cost of 27,000*l.*) within the last sixteen years, or so renewed that it amounts to the same thing; and instead of the old houses made of mud walls and thatched roofs, may now be seen throughout the whole of it good substantial tenements built of brick and covered with slate. They are decidedly above the average of farm buildings, and though not adapted to the use of steam-power or any other of the modern scientific improvements, are justly deemed well suited to the means of those who occupy them.

The farms are not large, the most important being from 180 to 200 statute acres, but the average is about 80; they were formerly let on yearly tenancies, but seven years is now the usual term, and some of the farmers are willing to enter into agreements for ten, but for the most part they are reluctant to bind themselves for so long a period. As a class they are incapable of estimating the responsibilities which the covenants of a lease entail upon them; in their anxiety to get the farm, they are willing to enter into conditions the force of which they do not understand, and which consequently they care not to fulfil; wanting in capital and energy both of body and mind, they are unable to appreciate or carry out an improved course of husbandry, and looking with suspicion on any plan which seems to differ from their own method, are reluctant to abandon the practice of breaking-up the land for successive grain crops; to preserve the greater part of the farm in grass is the aim and object which a good farmer ought to have in view throughout this district, but after such a process of exhaustion as the land has suffered during past years, it is impossible to restore it to anything like vigour without going through a judicious rotation of crops, and the system of the schedule, tried on this property, which binds the tenant to a fixed and regular course, though at first greatly disliked by him, is the only mode of accomplishing the object sought after. The rental of the land averages 30*s.* per statute acre, or rather more, and the rotation of crops, which is now adopted with success in working and restoring it, is a five-course, as follows :—

Out of ley—1. Oats.
2. Oats, a better crop than the first.
3. Green crop manured, turnips or potatoes.
4. Oats or barley, with seeds.
5. Seeds for hay or pasture.

And after that one year or more in pasture, according to circumstances, the object being to get a good permanent pasture for the dairy, and sometimes it is preserved unbroken for three years. The land is strong and retentive of moisture, and produces, after a fallow, a good crop of wheat, 25 or 30 bushels to the acre; but before any of these crops can be grown, it is necessary to drain it thoroughly. The first method of draining on this property, before the invention of pipes, was with horseshoe-tiles and stones, at a rate varying from 15*d.* to 18*d.* a rood of 7 yards, total cost, filled and completed, and 60,000 roods of drains were so laid at a depth of not more than 30 inches; but now a drain of 3 feet deep with a 2-inch pipe for the water, is found to answer admirably at intervals of 8, 9, or 10 yards, down the fall, at a cost of 11*d.* to 13*d.* per rood, including the tiles, cutting, laying, and filling. The understratum in which the tiles are laid is a stiff reddish clay, capable of being made into bricks or tiles; and the drains are, for the most part, laid 8 yards apart, with an *air-drain* carried along the top of the field, and communicating of course with the heads of all the drains. This admission of a draught of air is most advantageous, and may, in fact, be considered as *one of the great secrets of thorough tile-draining:* in meadow land, or permanent pasture, it is quite sufficient to bring the pipe up in a slanting direction to the surface; this plan I have *tried,* and it saves the expense of the additional air-drain.

A large brickyard and tilery has been at work on this property for more than 15 years, and the horseshoe-tiles were made in large quantities, as may be imagined from the length of drains named above, which was generally laid with that kind of tile, the opening turned upwards, and a stone placed as a cover. For the last three years pipes have been substituted for the horseshoe; and last year, 1848, upwards of 500,000 tiles were made in that yard, nor was this supply at all equal to the demand. There are two machines at work, Whitehead's and Clayton's, but the latter was used first, and I believe continues to be the favourite for large tiles, though the former is preferred for the smaller kinds.

From Barton, proceeding westward, we pass into the Fylde, which is divided into two parts by the Wyre; this river rises at the head of the valley that takes its name from the stream, and flowing by the small town of Garstang, passes thence with a considerable detour near the villages of Church Town, St. Michael's, and Great Eccleston, and finally empties its waters into the sea at the south-west corner of Morecambe Bay, forming there a harbour to the modern town of Fleetwood. The southern of these two divisions is much the larger of the two, but nearly all the mosses of this part of Lancashire lie to the north of the Wyre, and their history and present state must form one of the most interesting subjects in any treatise on the farming of the county. These original wastes may be roughly estimated at 20,000 statute acres, and from a state of perfect sterility producing nothing but moor-fowl and snipes, they are now being gradually converted into the most productive lands in the kingdom; this has been chiefly done by a good system of draining, and it is remarkable that the levels of this country should fall to the north. From within half a mile of the Wyre the water falls to the Lune, and from within two miles of the Ribble it runs into the Wyre, from which it is evident that to drain these districts thoroughly and to keep them in working order, it is absolutely necessary that the beds of these rivers should be kept as low as possible. From the constant washings from the hills and from repeated floods they bring down with them great quantities of sand, which, as the rivers widen towards the sea, and become more sluggish in their course, is deposited in the channel, to the manifest injury of the outfalls above. The natural scour is not sufficient to keep the rivers deep to the sea, and it is very necessary in any general drainage measure that particular attention be paid to this point. It is strange that Ireland should possess the Acts of 1 & 2 Wm. IV., cap. 57, and 5 & 6 Victoria, cap. 105, "To empower landed proprietors in Ireland to sink, embank, and *remove obstructions* in rivers;" and that England should be at this day without the benefit and power of any such laws. It is much to be hoped that this defect will soon be remedied.

Each division of the Fylde has its great landowner and improver: Mr. Clifton, of Lytham, in the southern, and Mr. Wilson Ffrance, of Rawcliffe Hall, in the northern; and both these gentlemen have indeed "deserved well of their country" for their eminent services in the cause of agricultural improvements.

The climate of the whole of this lowland district is much milder than in the higher parts of the Middle Division situated to the eastward; and the town of Lytham, at the mouth of the Ribble, has become, in consequence of its peculiar situation and warmth, a favourite place of resort during the winter months. The soil for the most part south of the Wyre is rich and loamy, lighter than on the eastern side of the Lancaster Railway, and capable of growing any crops, and when drained most productive. Towards the sea-coast, from Lytham to Blackpool and Fleetwood, the red marl prevails: but to the north of the Wyre it is almost entirely peat and moss resting on a substratum of marl and clay.

The character of the people and size of the farms are very similar to what has been already described of the lower part of this division, in the neighbourhood of Barton, &c.; but the Earl of Derby and Mr. Clifton, who owns a large tract of country in this district of the Fylde, have done much towards their improvement. The latter gentleman especially has endeavoured to introduce upon his property a higher system of farming, before unknown there, and with the help of his intelligent agent, Mr. Fair, has certainly accomplished great things. He established a private Agricultural Society, which gave a stimulus to improvement amongst his own tenantry, that has been attended with much good; the stock exhibited gradually improved, and the green-crop system has been successfully tried, and the example thus afforded of what might be done with care and skill has not been without its effects beyond the limits of that Society. Large dykes and drains have been made to carry off the water to the Ribble; one especially, which extends from five to six miles, was made at an expense of 3000*l.* entirely by the proprietor; and as a proof of the benefit resulting from this work, offers were immediately made of an increased rent, which would bring some return for the outlay, and gave encouragement for further similar undertakings.

Mr. Clifton, in carrying out his views, has also introduced from Scotland men of capital and position as tenant-farmers, such as were unknown before in this county; and by giving long leases of 19 or 21 years on large farms of 400 acres or more, has effected a change which promises to be very advantageous; but it yet remains to be seen whether or not, as a whole, the Scotch system is the one which is most calculated to suit this part of England. Mr. Begbie, one of these gentlemen, has kindly furnished me with some particulars relating to his own farm near Lytham, which are worthy of notice. Part of his farm he has drained 2 feet 6 inches deep; but during the last two years no drains have been made less than 3, and some 4 feet; the 3-feet drains being 6 yards apart, and the price paid for cutting and filling 5½*d.* to 6*d.* per rood of 8 yards. The 4-feet drains are generally placed 12 yards apart, and the price for cutting, &c., 8*d.* per rood; these latter have only been made when the subsoil was open and porous.

The last year he has used the pipe tiles with collars, $1\frac{3}{4}$ inch wide; but up to that time the horseshoe-tiles, with turf for a covering, or even turf alone, which forms an excellent drain when the subsoil is sound and stiff. Mr. Clifton supplies the materials and the tenant does the rest of the work, or Mr. Clifton does the whole, and charges a per centage. Hitherto Mr. Begbie has not been able, from the unformed state of his farm, to carry out any regular course of cropping, but now he proposes to adopt the seven-course shift, viz.:—

1st year, one-seventh of turnips.
2nd „ „ wheat or barley.
3rd „ „ grass and pasture.
4th „ „ pasture.
5th „ „ oats.
6th „ „ beans, drilled.
7th „ „ wheat.

The climate of the Fylde he finds to be wet and uncertain in autumn and winter, but good in spring and summer. He has a steam engine of 6-horse power for threshing and bruising corn, which can also be adapted to crush linseed without any additional power, at the same time with the threshing. Thick sowing for wheat is not so much in use here as elsewhere; 5 pecks in the autumn, until the middle or end of October, and 6 or $6\frac{1}{2}$ as the season advances, are commonly sown, and many persons at *the beginning of autumn sow under a bushel per statute acre.*

Two tileries have been established on this property: one, the largest, has been at work for some years past; and a second smaller one was erected last year.

From Lytham we must go to Rawcliffe, and examine the mosses to the north of the Wyre: a dreary country it is in its natural state, but the hand of man and the blessing of Providence upon his exertions are fast converting this wilderness into a garden; oats and potatoes, turnips, and even wheat, may be seen growing in the greatest luxuriance on the surface of a bog, perhaps *thirty feet* deep or more, for in some parts the moss is found to exceed even this, and the black peat-stacks of turf reared to dry for fuel may be seen standing in gloomy contrast with the smiling produce of the sickle.

To enter fully into the details of the method by which this extraordinary revolution has been effected would of itself require an Essay; but the limits of this Report will not admit of more than a full statement of the facts: nor is there space to enter upon the very interesting question of the formation and origin of the moss—that belongs more to the geological inquirer—our business is with the surface; but it is worthy of a passing remark, that large remains of oak trees, sound, and black as ebony, and of a size equal to the timber of the tropics, are found embedded under these mosses, as well as large horns of the red deer and elk.

The cultivation of moss-lands appears to be the original farming of Lancashire; that is to say, that branch of farming in which it has a peculiar character and position, differing from the other parts of the kingdom: Lincolnshire has its fens, Yorkshire its wolds, and other counties their distinctive characteristics; but Lancashire has its mosses, and whilst in growing turnips or wheat we are only doing what others can do equally well, or perhaps better than ourselves, to produce these crops upon the surface of a barren moss, varying from 3 to 30 feet in depth, is a triumph in agriculture—such as no other county, I believe, can lay claim to.

The value of moss has long been admitted; as far back as 1819, Mr. Nimmo says—

> "I am perfectly convinced, from all that I have seen, that any species of bog is by tillage and manure capable of being converted into soil fit for the support of plants of every description, and with due management perhaps the most fertile that can be submitted to the operations of the farmer."

And Sir H. Davy says—

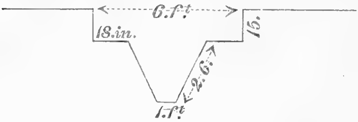
> "A soil covered with peat, is a soil covered not only with fuel, but also with manure; it is the excess of manure only which is detrimental, and it is much more easy to destroy than to create it. To cultivate a bog is a much less difficult task than to improve a sand. If there is a proper level to admit of draining, the larger the scale of operations the less must the comparative expense be, because machinery may for many purposes take the place of manual labour; and the trials which have been already made by private individuals, and which are stated in the different reports, prove not only the feasibility of the general project, but afford strong grounds for believing that capital expended upon it, after mature and well digested plans, would in a very few years afford a great and increasing interest, and would contribute to the wealth, prosperity, and population of Ireland."*

Now in converting moss into land the first matter to be considered is the *main drains,* and these must be determined on with reference to the extent, form, and situation of the moss, to the levels of the lands by which the moss is surrounded, and likewise to the levels of the *subsoil* on which the moss rests.

Roads, having open drains on each side, must be made as a general rule 7 yards wide, and must be laid out so that the fields and their divisional drains run at right angles with the lines of the roads. The open drains on each side of the roads are made for the first year 3 feet wide at the top, 1 foot wide at the bottom, and 4 feet deep; but in the second year, when the moss is sufficiently consolidated, it is desirable to make these drains 6 feet wide at the top: at 18 inches from the surface this width of 6

---

* For this testimony see Irish Farmers' Magazine, No. 29, March, 1836, p. 100.



feet is contracted to 3 feet by a square ledge of 18 inches on each side, so that a section of the drain is of this form. This additional cutting may increase the cost 2*d.* per rood; but it has been found that the ditches so cut stand better than the old drains 3 feet wide, inasmuch as the superincumbent weight being removed, the drain is not so likely to spew up *at the bottom,* for it is not so much the sides falling in from the top as the *pressure from the bottom* that injures a ditch of this kind. The stuff taken out of the drain is thrown into the centre of the road, and when tolerably dry and ready for sanding, the road is formed, and sand or gravel laid on 12 feet wide, 4 inches thick in the centre, and 7 inches on each side, the object of this additional weight at the sides being to keep them down.

The moss should be laid out in fields of 300 yards long, and 66 broad. This form contains 19,800 square yards, or 440 square yards more than 4 statute acres; a little more than 2½ acres customary, of 7½ yards to the perch. Each field takes 2 end drains and 1 side drain; and the covered drains in the field should be 10 yards apart, so that one field of about 4 acres has 1 side drain, 2 end drains, and 28 covered drains. The expenses of draining are calculated after the rate of 8 yards to the rood, as follows:—

2 end drains . . .	16½	roods of 8	yards
1 side do. . . .	37½	do.	do.
	54	roods.	

These end and side drains to be—

3 feet wide at the top,
1 foot do. bottom,
4 feet deep,

being the size of the open drains at the sides of the roads, &c., for the *first year,* and the mode of work and price as follows:—

	Inches.		£.	*s.*	*d.*
1st sod, deep	14	5½*d.* per rood, for 54 roods .	1	4	9
2nd do. do.	10				
	24				
3rd do. do.	12	3*s.* 6*d.* per 100 yards, for 54 roods	0	15	2
4th do. do.	12				
	48		£1	19	11

The 5½*d.* per rood includes the throwing the stuff from the sides of the drains on to the road, or into the field, and chopping it.

Cutting the ledges, 2*d.* per rood, for 54 roods .	0	9	0	*second year*
	£2	8	11	

The form of a covered or field drain is—

14 inches wide at the top,
6 do. bottom,
3 feet deep,

and to be worked thus—

1st sod,	14 inches deep	7*d.* per drain
2nd do.	10 do.	6 do.
3rd do.	12 do.	11 do.
	36 inches.	24*d.* per drain.

The first sod makes the wedge-sod, and when dry will be 9 or 10 inches thick; when taken out it is put on its side on the right of the drainer to dry, and the second or third sods are thrown out to the left, and chopped to fill up the drains when wanted; pattens are used by the workmen, as on Chat-moss. The breadth of field is already fixed at 66 yards; but it is calculated as 8 roods, or 64 on payment, so that one covered drain cost 2*s.*, or 3*d.* per rood, and the 11*d.*, being the third charge, includes the returning and fixing the wedge-sods, and filling up the drain, &c.

The whole expense of draining a moss-field, rather more than 4 statute acres, will be as follows:—

	£.	*s.*	*d.*
1 side drain, 37½ roods of 8 yards.			
2 end drains, 16½			
54 roods	2	8	11
28 covered drains at 2*s.*, being 10 yards apart	2	16	0
Total expense for 19,800 square yards	£5	4	11
Per statute acre, 4,840 do. about	£1	6	2
Per customary do. 7,840 do. do.	£2	2	0

The expenses of the main drains and the roads must be charged to the whole moss drained.

For the above particulars, and any others connected with these mosses, I am indebted to the kindness of Mr. Wilson Ffrance, of Rawcliffe Hall.

This gentleman had allotted to him, about 19 years ago, 736 statute acres of moss, which he immediately set to work to improve; it is now all under cultivation, producing beautiful crops of oats and potatoes, except 8 acres upon which the drainers are now employed. He has drained it all on the plan given above, made roads, &c., and after draining, marl, which is found under the moss, is laid on the top at the rate of 150 to 160 tons per customary acre, by means of a moveable railway as on Chat-moss.

The marl is calculated by the fall, which is 64 cubic yards; 1 and ½ fall to the customary acre. The cost of this is thus estimated:—

Fall of marl	64	cubic yards.
1 cubic yard weighs	32	cwt.
	128	
	192	
1 fall =	2048	cwt.
½ ,, =	1024	,,
1½ ,, =	3072	,, or 153 tons 12 cwt. to the acre.
1 waggon takes	23	cwt.
134 ,,	3072	,,

One horse will draw 35 waggons a day, generally taking 2 waggons at a time, in summer; the marlpit being a quarter of a mile from the moss-field.

35 waggons × 4 days = 140 waggons.

	£.	s.	d.
2 men in pit 4 days, at 2*s.* 6*d.*	1	0	0
2 men in field, spreading, &c. 4 days at 2*s.* 6*d.*	1	0	0
1 boy driver	0	4	0
1 horse	0	12	0
Oil and extras	0	4	0
	3	0	0
1 fall and ½, or 96 cubic yards of marl, at 7*d.* per yard	2	16	0

which is about the price; for it does not take quite 4 days, nor 140 waggons; and therefore the cost of draining and marling, with about 153 tons of marl, one customary acre of 7½ yards to the perch, is 4*l.* 18*s.*, being about 3*l.* per statute acre.

To carry all the water from the extensive area of Rawcliffe-moss, and others adjoining, it has been necessary to open a large dyke 5 or 6 miles long. This little canal is made by a circuitous course to fall into Morecambe Bay, passing through Pilling; but so flat is the country, that it has not more than 7 or 8 inches of fall in a mile. The cost of keeping this dyke clear is paid by the proprietors, through whose lands it successively passes.

The moss-land is found to produce the best potatoes of any known; and whilst in other soils the failure of this crop has been a total or partial loss to the cultivator, the moss-farmer is reaping an abundant harvest. On the customary Lancashire acre he can get

	£.	s.	d.
60 loads of large potatoes at 10*s.*	30	0	0
20 ,, small ,, 7*s.*	7	0	0
	37	0	0

One load being equal to 240 lbs.; and the above price is taken from the average of the first six weeks of this year in Garstang market. The present price is 13*s.* 6*d.*

As may be imagined, it is not difficult to let such land: an instance of the value in which it is held occurred not long ago on a property adjoining that of Mr. Ffrance. A man of the name of Fawcett took a farm of 36 customary acres (about 60 statute) for 73*l.* per annum, and sublet 12 of the 36 at 6*l.* per acre, thereby keeping for his own use and occupation 24 customary acres, at a rental of *one pound* per annum.

Another man, who came as labourer from Chat-moss a few years ago, and is commonly known as "Chat-moss Joe," now holds a farm under Miss Harrison, at 70*l.* a year, and the value of the whole 736 acres belonging to Mr. Ffrance may, on the lowest calculation, be estimated at the annual rental of 1*l.* per acre, which, on an outlay of 7000*l.*, is rather more than 10 per cent. The moss, when reclaimed, is let in lots by ticket, subject to certain conditions, one of the most important of which is, that the tenant shall keep the divisional ditches open on the side and ends of his allotment, to the full width of 6 feet at the top and 4 feet in depth; and in case of failure, the landlord to have the right to re-enter. Not longer ago than the 19th of December last year, an allotment of 2 A. 2 R. 5 P., of customary measure, equal to about 4 statute acres, was let by Mr. Ffrance for 8*l.* per annum; and for another, rather less, as much as 12*l.* was offered;—such is the competition for this kind of land during the present value of potatoes.

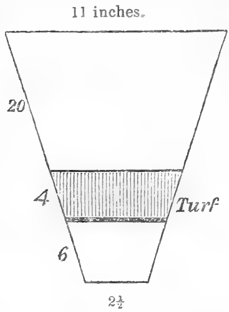
But Mr. Ffrance is not content with draining the moss itself; he also makes it subservient to the draining of the lands adjacent. In a letter to the editor of the 'Mark-Lane Express,' dated January 1st, 1840, he describes the process of making turves from the moss, which in a clayey subsoil were found to answer almost as well as tiles. He says, "The turves are cut from the peat where the moss cuts fibrous and tough, which usually may be 6 or 8 spits deep: below that depth lies a blackish-brown turf, the moss being in a more advanced state of decomposition, and such is not considered so well adapted for making draining-turves." The turves are cut with a spade made with sides 12 inches long, the sides 5 inches in depth—7 inches wide at the top, and tapering to 6 inches wide at the bottom.

"The expenses of completing the turves ready for use have hitherto been—

	s.	*d.*	
Cutting the draining-turf . .	2	0	per thousand.
Wind-rearing ditto to dry . .	0	3	,,
Stacking ditto	0	6	,,
Total	2	9	,,

In consequence of the moss drying up, and some becoming shapeless, 28 turves upon an average will drain a rood of 7 yards: the cost of the 28 turves being (at 2*s.* 9*d.* per thousand) nearly 1*d.*"

He then describes the drains made by him as 30 inches deep; 11 inches wide at the top, and tapering to $2\frac{1}{2}$ inches wide at the bottom, the underside of the turf when wedged in being about 6 inches from the bottom of the drain, and calculates that the cutting, laying, and fitting in the turf can be done for 4*d.* a rood of 7 yards; so that the whole expense of draining a statute acre will amount to 1*l.* 15*s.*, the drains being 10 yards apart:—thus,



	s.	d.
28 turves for 1 rood of 7 yards	0	1
Cutting drains, laying and fitting in the turf . .	0	4
Carting turves to the field and clay from the drains	0	1
For 1 rood	0	6

A statute acre, say 70 × 70 (4900 square yards) has 7 drains, 70 yards long each = 70 roods = 35*s.*

These drains have been known to last perfectly sound in clay for 50 or 60 years; and, saving vermin, there is no reason why they should not continue efficient for a much longer period.

Mr. Ffrance has, within the last two years, established a tilery on his property; he now drains his clay lands with tiles 3 feet deep, and instead of using collars places a turf *under* the joints of the tiles where necessary, and turves over the pipe-tiles to *cover the crevice,* and relieve the tile from all pressure. This mode of using tiles and turves together does, in fact, make a double drain, which, under all ordinary circumstances, is not likely to get out of order; and the cost of the turves over and above the tiles is not more than 5*s.* per thousand, including carting, &c.

The custom of paring with a push-plough, and burning the moss for oats after draining, prevails amongst the tenant-farmers in this district, and they pursue this for two or three years in succession; then, for a change, take a crop of potatoes or seeds, always burning the surface till the moss is reduced in thickness. On a farm of the Duke of Hamilton's, on Nateby-moss, with which I am acquainted, the practice is, after draining, paring, and burning—

1. Oats—if dirty, the burning repeated;
2. Green crops, turnips, potatoes, &c., with farm-yard manure and guano;
3. Marled and ploughed for spring wheat or barley; and
4. Seeds for mowing or pasture to lie one year, and then pared and burnt again for oats as before.

Proceeding northwards towards Garstang, and from thence to Lancaster, we come into the extensive property of the Duke of

Hamilton, which, from the woods of Ashton Hall to the moorlands of Barnacre and Wyersdale, includes a large tract of country. Under the superintendence of Mr. Lamb great improvements have been effected on this property, and in a district containing so great a variety of soils and situations as this does, it requires no ordinary skill to adapt to each the proper treatment.

Eleven years ago the Duke of Hamilton established the Ashton Agricultural Society for the purpose of offering encouragement to exertion amongst his own tenantry: the premiums were confined exclusively to them; whilst by the adoption of open sweepstakes a general competition was also admitted. This Society still flourishes; and the effect has been very beneficial, not only to a great majority of the Duke's tenantry, but to the whole of this part of the country. To assist in the improvement of the stock, his Grace has purchased, within the last few years, several bulls of first-rate pedigree, at prices varying from 40*l.* to 60*l.* and 80*l.*; and calves at less prices. Three of these bulls have been regularly kept on the estate, and are replaced as occasion required.

Both the standard of stock and general management of farms have been greatly improved. Amongst other results Mr. Lamb has informed me that there has been a great increase in the growth of turnips; in fact, one farm now produces as much as the whole estate did eleven years ago.

On the low lands, where a regular system of arable culture is admissible, the following rotation of crops is now adopted:—1st, oats; 2nd, turnips; 3rd, barley, and grass seeds, to remain in pasture for two or three years. On the higher lands, exposed to the severe winds and storms from the westward, and where the soil is poor, the meadows and pastures are generally preserved unbroken. Mr. Curtis, who occupies the Heald—a high farm in Barnacre, of 109 customary acres, equal to 180 statute, and at an elevation of 500 feet above the sea—has tried a course of oats, turnips with guano, and oats with seeds, with tolerable success. He does not recommend swedes in the high moorish soil, as, from his experience, they do not keep well.

The draining on the whole property is done on a very extensive scale: in 1847, 50 miles of drains were cut; and in 1848, not less than 62 miles, at the following rates, and at depths varying from 3 ft. 6-in. to 5 ft., with 2 in. pipes, and 3-in. ditto for main drains:—

	ft.	in.	*s.*	*d.*	
Cost at a depth of	3	6	0	9½	per rood of 7 yards
,,	4	0	1	0	,,
,,	5	0	1	6	,,

the width between the drains being 7 or 8 yards. The prices vary, of course, according to the substratum, but these are generally paid for the cutting and filling. To this must be added the cost of the tiles, which is 19*s.* per thousand for 2-inch bore, and 30*s.* ditto for 3-inch ditto, and the laying them, which is done by the day. To accomplish the draining on this estate it was found necessary to erect a tilery in the spring of 1845, which has been in active work ever since, the supply of pipe-tiles being by no means equal to the wants of the district. During the last year, 1848, 598,617 tiles and 33,029 collars were made there by Clayton's machine.

The farms vary in size, from 20 or 30 acres to 460, which is the largest on the property, the rent varying from 10*s.* to 50*s.* per statute acre; the majority are held on yearly tenancies or on terms of 7 years, and some have leases for 14 years.

In the township of Nateby the land has been let on an oatmeal-rent since the year 1822, or, in other words, the rent varies according to the price of oatmeal; and at Cabus half the rent is paid in wheat and half in money: these customs are peculiar to these townships. In a farm in Nateby, to which I have already alluded, of 151 statute acres, the variation in two years has made a difference of 70*l.* in the rent. In 1848 it amounted to 190*l.*; whereas in 1847 it was only 110*l.*, the rental being reckoned according to the price of oatmeal the previous year.

Mr. Ford, of Ellel, and Mr. Richard Hinde, of Lancaster, at his farm on Ellel Moor, have both set a good example in their several districts: the latter gentleman deserves especial mention before we leave this division; for in Mr. Dickson's Report (p. 194) it is said of the improvements attempted there, that they had *failed*:—"Ellel Moor, near Lancaster, notwithstanding lime has been laid on and the ground treated according to the usual custom of improving wastes; yet, after a few crops taken, seems verging back towards its original state of poverty." Mr. Hinde has kindly favoured me with the following interesting particulars respecting the present state and cultivation of his farm, Newlands Hall, situated 6 miles south-east of Lancaster; it lies exposed to the west winds, and is about 300 feet above the sea:—

"Ellel Moor was inclosed by a special Act in 1756, laid out into farms, and brought under cultivation. Draining and trenching have both been carried on from time to time to a limited extent, but not on a regular or fixed system. The soil is from 2 to 5 inches deep, growing in its natural state—rushes, whins or gorse, alder bushes and heather; it lies upon a yellow bastard clay, full of stones, and frequently containing large quantities of oxide of iron, making it very hard to cut for drains; the rock is the millstone grit; the land varies so much, that there are hardly two acres exactly alike. I took possession of the farm, which consists of 77 statute acres, in November, 1843. It has an excellent house and good farm buildings. The tenant had been on it for twenty-two years at a rent of 44*l.* per annum; but for want of energy, and from bad management, he had brought himself to a stand still. I commenced draining, trenching, and sub-soiling. I did not cut any drains the first year on the thorough-draining principle, not feeling sufficiently informed of, or confident in, the system; since then I cut them 30 inches, and latterly 3 feet deep, at 7 yards apart, upon Mr. Smith of Deanston's plan, and find them answer extremely well. I occasionally used 1¾-inch tiles, and at other times, from the quantity of stones there are, sough-drains, with broken stones on the top. I have been successful in most of my crops: in 1845 I gained the premium for the best crop of swedish turnips at the Lancaster Agricultural Society's Show, competing with the best lands in the neighbourhood of Lancaster—Burton and Milnthorpe; the crop weighed 24 tons, topped and tailed, to the statute acre. In 1846 I had 8 A. 3 R. statute of turnips, cabbage, mangold, and potatoes; the field was thorough-drained, but neither trenched nor subsoiled; it was formerly two fields, and I expended 75*l.* in draining, levelling fences, picking stones, &c.; and I may here mention that the value of the land, as made by two most experienced land-valuers at the time I bought it, was 6*s.* per acre for one field, and 8*s.* per acre for the other, at twenty-six years' purchase. The crop was not weighed; but I sold by auction 2A. 3R. 35P. statute of swedes, which realized me 47*l.* nett towards the outlay of 75*l.*, leaving me above 5 acres for my own; last year I mowed a most excellent crop of rye-grass; so that I think it has nearly redeemed itself, and is in a very different condition to what it was. In the winter of 1847 and spring of 1848 I trenched and drained 6 acres of old ley, and trenched 4A. 1R. 35P. of oat-stubble for green crops, the account of which I give below. The plan I proceed upon is to set my trenching in beds of 7 yards wide, the fall of the land, a drain being cut on each side of the bed. I provide, in the first instance, stones for the first two or three drains, and then commence trenching to the depth of the soil only, breaking up the subsoil to the depth of 10 or 12 inches with a pick, and throw all the stones on the top of the trenched land. This year I have used strong forks about 7 lbs. weight, with a projection at the back in this form T, in order to give more leverage. I prefer them to the pick, being, I think, more effectual, and easier for the men. Whilst the trenching is going on, I have other men cutting the drains in the entrenched land, and the stones on the trenched land are wheeled in barrows to the drains, the land abounding so in them that they have seldom to wheel them more than 14 or 20 yards, so that I hardly ever have a horse and cart in the field. I believe this plan to be the cheapest and most effectual for my land, and I have given up the subsoil-plough; the trenching is done by the customary measure of 7 yards square to the rod, or fall, as we call it; the price 8*d.* to 9*d.*; at which price a good man can earn 2*s.* to 2*s.* 3*d.* per day; the drains are cut by the rood of 7 yards long, 3 feet deep for stone soughs at 7*d.* and 30 inches deep for pipe-tiles at 5½*d.*; the soughs are made, tiles laid, and stones filled, and drains filled up, by day-work.

"Expense of thorough draining, at 30 and 36 inches deep, and 7 yards apart, trenching, &c., 6 statute acres of old ley on Ellel Moor:—

	£.	*s.*	*d.*
Grubbing whins	2	5	0
,, alder-bushes	1	12	9
Trenching 595 falls of 7 yards square, at 8*d.* .	19	13	8
Cutting 685 roods of drains at 6*d.*, tiles, stone-breaking 258 cubic yards, laying tiles, filling up drains, &c.	45	18	11
Labour, getting up large stones and alder-bushes, not let by contract, &c.	10	0	0
	79	10	4

"I removed 920 one-horse cart-loads of stones from the land after it was drained and trenched, which I sold to the Surveyor of Roads, and which paid for the removal, the road being alongside the field, besides 70 loads of good rubble walling-stones from the large stones we had to break up with hammers and wedges. I sowed the field with Scotch lean oats, and gave it 2 cwt. of Peruvian guano to the acre; it produced 197 thraves, the band being made small on account of the wet season; the straw was strong and full, but I have not weighed it for thrave. In corn it gave 44½ bushels per statute acre, of 39 lbs. to the bushel; and having made meal several times, I find it gives me 4 loads of 240 lbs. to the load per statute acre. I am now ploughing it for a second crop of oats with a hand-dressing, probably superphosphate of lime; and the condition of the land is most satisfactory.

"From the 4A. 1R. 35P. of oat-stubble which I trenched, I removed nearly 500 one-horse cart-loads of stones, and sold most of them to the roads. I sowed it with swedes, mangold, carrots, and a few potatoes; and considering the wet summer, I had a very fair crop of swedes, about 18 tons to the acre; and with what I have sold and have to sell, I shall more than twice cover the expense of trenching. For mangold-wurzel on poor lands like mine, independent of the muck put into the stitches, I strongly recommend the practice of dibbling in with a trowel every 10 inches a prepared compost, and placing the seed immediately upon it. The compost I made last year consisted of bones, horse-feet parings from the blacksmiths' shops, hen-manure, which I carefully save, and ashes, or, still better, refuse charcoal: these were put into a heap under cover, and well wetted with tank-liquid, and left to heat for two months. I have a light wooden roller, the same as a garden roller, 30 inches in diameter, with three strips of wood projecting about an inch railed on at every 10 inches longitudinally; it covers two stitches at once, 30 inches between each, and is drawn by men, and consequently levels to the top of the stitch, and leaves a mark every 10 inches. The compost is put into buckets, and with a garden-trowel the labourer takes out a trowelful of earth and replaces it with a trowelful of manure. The cost of doing this per acre is from 10*s.* to 12*s.*, if done with men: could women or boys be had, it would be less. I steep my seed in liquid manure twenty-four hours, and put in a bag two or three times larger than required, in order to be able to turn the seed and lay it on the midden in a gentle temperature from four days to a week. The bag must be turned every day, and great care taken not to place it in too hot a berth. Last year my hind overheated and destroyed the seed, and the consequence was I had at the third weeks' end to redibble fresh seed; notwithstanding which I had nearly as fine a crop as any I saw in the better land in the neighbourhood of Lancaster, owing to the compost and liquid manure. I dibble the seed in with the finger and thumb, placing three seeds at a little distance from each other in the compost at every 10 inches, and cover lightly with the finger. I have thus had it up in a week from the time of sowing. For carrots I recommend, after they are weeded and about 2 inches high, to give them, if the weather be damp, 1 cwt. of guano and 1 cwt. of gypsum per acre, sown on them early in the morning. I did so last year upon my crop, which I thought worthless, and the effect was astonishing.

"*Rotation.*—My general rotation is—of old tough ley, two crops of oats, both hand-dressed; two, turnips, mangold, drilled beans, potatoes, cabbages, and carrots; three, oats, with grass seeds, either mown or left to pasture three or four years—if mown, ploughed up earlier. I do not, however, follow strictly any rotation, but depend entirely upon the condition the land is in. I have two liquid-manure tanks, and attribute my success in growing green crops mainly to its use upon the first appearance of the plant. My common turnips were sown very late last summer; and in applying the liquid manure when in seed-leaf several rows were missed. The result was that I had not one-third of a crop on that portion, the fly destroying them; and what remained, for the want of a stimulant and ready concocted food—liquid manure—made very poor progress, the season being late.

" *Manure.*—Since 1843-4, my first two years, I have bought no heavy manure, and very little guano—about a ton to 25 cwt. per ann. I find it the most advantageous to make the manure on the premises, by buying linseed and straw for bedding, and laying on as many cattle in the winter as I can accommodate for feeding. I have never bought a single ton of horse or cow manure—only night-soil from the factories, which nobody thought much about, when I first commenced.

" *Cattle.*—The greatest number of cattle kept by the last tenant were in summer never more than five milch cows, and about four or six head of young stock, a pig, and two horses. In 1846 I milked fifteen cows, besides having young stock; three horses, and three brood-sows and store-pigs. Last summer I milked twelve cows, having rather more under the plough; and this winter I have nine milch cows, two two-year-olds, and five fat beasts in my shippon, five yearling calves, one back-end calf, two nine-months-old bulls, three horses, two brood-sows, and eight store-pigs. I have grown Italian rye-grass, and mown three crops; and now that the land is in better condition for it, I shall sow it again. I grew a very heavy crop of tick-beans in 1847, broadcast, and well mucked with farm-yard manure. The extent of land was a customary acre, or 1A. 2R. 20P. statute, and I had sixteen loads of 280 lbs. to the load and 147 lbs.

(Signed) " RICH. HINDE."

Northern Division—No. 3.

To the north of the river Lune the county becomes rapidly contracted in its limits, being confined on the one hand by Westmoreland, on the other by the sea; over the sands to the north-west there is the rich district of Furness and a hilly tract of some extent, which naturally seems to belong rather to Cumberland and Westmoreland than to this county. Throughout the whole of this northern division the transition limestone, slate, and greywacke strata prevail; and the difference in the improved appearance of the surface is very perceptible, whilst the cultivation is decidedly superior to many other parts of the county. Furness seems to be the *redeeming feature in Lancashire farming.* In the soil, the class of farmers, and their general management, this district would not suffer by comparison with other more favourable and accessible parts of England. It is difficult to conceive two districts more distinct in every respect that can interest a farmer than that on the eastern side of the southern, and this on the western part of the northern division of the same county. The one cold and wet, growing a bad herbage and rushes, and divided into small holdings, with a manufacturing population, who, *occupying* the land, cannot be said to *farm* it; the other for the most part naturally drained by a substratum of gravel and limestone, in the occupation of men who pay, in some instances, as much as 600*l.* a year rent, producing beautiful crops of wheat, oats or barley, turnips, and seeds. Soil of every variety, from a strong clay to a light sand, may be found within the limits of this division; but it is generally light and friable. In the neighbourhood of Cartmel and Holker there is a good deal of hard land—stony, but very productive. Over-sands, around Ulverstone and through the whole district of Furness, it becomes stronger, of a red loamy nature, and produces good crops of grain; on the sea-coast it is lighter and more sandy. There are two distinct classes of farms in this district—those which belong to large landed proprietors, such as the Earl of Burlington, the Crown, and others; and those which belong to small freeholders. The former are large, and superior in number and class to other parts of the county; they range from a rental of 150*l.* to 400*l.*, and some few higher than that, even to 600*l.* per annum. The latter are freeholds of not more than 40 statute acres, the property of a class of men known in that country as "statesmen," who, living on their own farms from generation to generation, are content with their small inheritance; and not having wealth nor the means of procuring it, live a primitive and independent life amongst their native hills. These men were formerly the worst farmers in the district, but they are now becoming more alive to their own interest, and willing to profit by the good example of their neighbours. What Mr. Dickson wrote of this district in 1814 is still true with respect to the occupation and size of the farms. To the north of the Lancaster sands they range from 20 to 100 statute acres; but farther north, in the vicinity of Ulverstone and in Low Furness, they are as high as 300 or more; and the Furness Abbey farm, Gleaston Castle, and Holbeck, the property of the Earl of Burlington, still hold the first rank. The rental of land in this district ranges from 15*s.* to 32*s.* per statute acre. There is not much wheat grown now in the northern district, except on Walney Island, off the west coast of Furness: the prevailing grain crops are oats and barley, the latter being taken by the maltsters at Dalton and Ulverstone. The rotation formerly was, out of ley—1st, oats; 2nd, barley, manured; 3rd, clover; 4th, oats; and grass seeds, or turnips after oats; but the course is now improved to—1st, oats; then, where the sward is old and tough, a second year of oats; 2nd, turnips, manured, or potatoes; 3rd, barley; 4th, seeds for two or three years. This land might be made equal to a four-course shift, but it will not do yet; and when wheat is grown, it is not advisable to dispense with a fallow. In Walney Island wheat is grown generally, and the system is—summer fallow, wheat drilled, beans, barley or oats. Mr. John Patterson, of Holbeck farm, to whom I am indebted for much of my information respecting this district, came from Northumberland about 19 years ago, and, after his long experience of the country, finds no reason to complain either of the soil or the climate; the latter, though more rainy, he finds not so cold as on the eastern side of England. His farm is about 340 statute acres, and for the most part naturally drained, with a rich loamy soil capable of growing anything. His system of cropping is as follows:—1st, oats, say 60 acres; 2nd, fallow 30 acres, turnips or mangold-wurzel 30 acres; 3rd, wheat after fallow and seeds, barley and seeds after turnips; 4th, seeds for two or three years, and so on *vice versâ,* taking care that all the land lies fallow in turn, as he considers it quite indispensable, on account of the scarcity of hand labourers in the district. He grows from four to five quarters of wheat to the acre, and considers 25 to 30 tons of turnips a good crop. Rape has been grown in the district and eaten off, but it is found that the crop of turnips next succeeding it in the course is not so good, and consequently it is becoming unpopular. His farm buildings are commodious, with yards and sheds for his young stock attached, and the whole district is well provided in this respect; Lord George Cavendish, of whom Mr. Dickson makes frequent mention, having taken great pains to improve them about 30 or 40 years ago. The farms on this property are mostly held on yearly tenancies; leases are not asked for, and therefore they are not granted; but his Lordship, under the advice of his able and active agent, Mr. Drew, has lately introduced a new form of agreement, by which the tenant is bound "not to take two white-straw crops in succession (except the field has been ten years or upwards in grass, when a second straw crop may be taken), nor in any year to have less arable land in fallow, turnips, or other green crops, properly cleansed and manured, than is equal to half the land sown with white-straw crops, and shall not grow white straw, corn or grain, on more than 2-5ths of the arable land." He has also added compensation clauses for unexhausted improvements, as is customary in Lincolnshire; and this is allowed (on the fulfilment of certain conditions) to the outgoing tenant, whether he give or receive the notice to quit. The proportion of the proposed conditional allowances to be regulated as follows:—

"*For bones* used on the land; the allowance to extend to three years; half the cost price to be allowed after one crop, one-third after two crops, and one-fourth after three crops. *For guano* used on the land, the allowance to extend to two years; one-third of the cost price to be allowed after one crop, and one-sixth after two crops. *For rape-dust* used on the land, the allowance to extend to one year; one-third of the cost price to be allowed after one crop. *For linseed-cake* used for feeding cattle and sheep, one-third of the cost price to be allowed for that which has been used since the 1st of October then last, and one-sixth of that used during the preceding twelve months. N.B. Cake given to horses, no allowance for."

Draining, when necessary in this district, has been done chiefly with horseshoe-tiles, and for soles the refuse slates from the quarries of the country. There are four tileries in Furness, two belonging to the Earl of Burlington, and two to other parties. In the former they have made pipe-tiles, during the last year, of 1½-inch bore, still using the horseshoe for the main drains. The drains are cut 3½ to 4 feet deep, at intervals varying from 10 to 14 yards; and the whole expense of making the drains, carting the tiles, &c., is paid by the landlord, and the tenant charged 5 per cent. on the outlay.

In the year 1838 the *North Lonsdale Agricultural Society* was established; the shows are usually held at Ulverstone, some time in October; and to this Society may be attributed in some measure the great improvement in stock and farming, but especially the former. But to Mr. William Cranke, of Hawkfield, is due the merit of *first* introducing the short-horns into his native country of Furness. As far back as 1813 this gentleman brought some of this stock from the banks of the Tees. They were not favourably received, and for a long time after their arrival the old long-horns kept their ground; but in 1838 this gentleman received from his friends and neighbours a substantial proof of the high opinion in which they held his services as an agriculturist, in the shape of a silver salver of 25 guineas; and, as a whole, the stock Over-sands is equal, if not superior, to that of any other district in the country.

I have thus endeavoured to describe the soils and important points in the general or particular management of land throughout this county, with the chief improvements and alterations at present going on; and I propose now to consider separately under their respective heads the character of their buildings, stock, implements, &c.; with the improvements still required in the reclamation of waste lands, and conclude with a few remarks on the present prospects of agriculture in Lancashire, and the condition of the farm-labourers.

Buildings.—The materials of the buildings in this county are brick and stone, and vary according to the different situations and circumstances of the districts. These are, however, easily defined: throughout the whole of the eastern or northern parts, the rough stone buildings prevail, with flags or slates for the roofing. On the low country to the south and west, where stone is scarce and clay abundant, bricks are in use, with thatch; but in the better class slate is found, imported either from North Wales or brought from the north of the county. In the low alluvial districts the old houses and cottages were made by a framework of wood, filled up with wattled stud-work, and covered over with a composition of clay and wet straw, locally termed *clat and clay;* these houses are thatched with straw, and, being whitewashed inside and out, have a tolerably clean and picturesque appearance when new; but they are frail tenements at the best, and apt to get out of order, and are rapidly disappearing in favour of more substantial habitations. The farmsteads are for the most part badly arranged, with little attention paid to ventilation or the economy of space and labour, now considered so necessary in a well-regulated farming establishment. The hay and grain crops are generally housed in large barns, which form a prominent feature in the yard, whilst the humble but more important requisites of steaming-apparatus, with chaff and turnip-cutting machines, are seldom met with; large boilers are sometimes used by the more intelligent farmers, who are now beginning to discover their true interests in this respect.

Stock-Cattle.—The Lancashire long-horned cattle were once famous all over the kingdom, and prevailed throughout the county; they were remarkable for the great length of horns and width between the tips, sometimes as much as 4 feet, and even more; the hide, thick and firm in its texture, was well adapted to resist the climate; and, though they did not give very much milk, it was considered to afford more cream in proportion to its quantity than that of other kinds. Mr. Bakewell, of Dishley, is said to have made them the basis of his improvements in stock. As oxen they are quite unprofitable, and not being good feeders they have gradually given way to the short-horns, which are finer in the bone and hide, and in fatting quality superior to any other breed. At Woodacre Hall, near Garstang, Mr. Daniel, a tenant of the Duke of Hamilton, on a farm of nearly 500 statute acres, has still some of the old and now despised long-horned breed, and prefers them for their hardy constitution and the quality of their milk. He maintains that 7 quarts from one of his cows will give as much butter as 10 quarts from a short-horn. They are longer in coming to maturity, but they also last much longer, and will produce calves up to fourteen or sixteen years of age. I saw the horns of one, measured by him, which were 6 feet 1 inch from tip to tip: the tape being taken down the horns and across the head. Many gentlemen have endeavoured to raise the standard of stock in the county: in the northern districts Mr. Cranke, of Hawkfield, Messrs. Patterson, Holbeck, Mr. Ashburner, Mr. Ormandy, and a few others in Furness, and Mr. Robinson, near Ulverstone, the Earl of Burlington, Mr. Rawsthorne, of Heysham, near Lancaster, Mr.

Wm. Garnett, of Quernmore Park, the late Mr. Ford, of Ellel, Mr. Birchall, near Preston; and in the south Mr. Bannerman, near Chorley, Mr. Eastwood, near Burnley, and Mr. Harvey, near Walton, Liverpool, have each contributed to introduce high-bred animals; but the finest short-horn stock in the county is perhaps Mr. Townley's, of Townley, near Burnley. By recent purchases this gentleman has collected together a most valuable herd, which must help to improve the stock, not only in the Southern Division, but throughout the county generally.

Sheep.—There is no breed of sheep peculiar to this county: nor, except in the hilly districts, are they an important item in the farming stock. Large flocks of the black-faced breed ramble over the eastern moors of the Middle Division, very inferior to what they might be with a little care and attention in the breeding. Early in the spring they are put on the hill pastures, where they remain till November; they are then brought down into the enclosed lands, and salved with a mixture of butter and tar, to prevent their having the scab and losing their wool in the early spring; the young animals, or hogs, in the first winter suffer from the blackwater, a disease brought on by exposure to wet and cold. The best remedy for this would be the erection of sheds, however simple and rude in construction, in which the sheep might be protected from storms both by day and night, a luxury at present unknown to these poor animals. In the hills of the Northern Division there is a considerable improvement; and on the fine lands of Furness a large white-faced sheep, a good deal like the Leicester, prevails. Lord Burlington has lately introduced at Holker the South Downs, which answer exceedingly well, and the successful result of the experiment seems likely to lead to their general introduction into these parts. Mr. Robert Garnett, of Wyreside, has taken some pains to introduce a better class of black-faced sheep, and about four years ago sent down to the Highlands for a flock of the improved Scotch breed. He has met with little encouragement amongst the farmers of his district: some few, however, begin to appreciate them, and their value is now much beyond that of the common sheep of the county. Mr. Smithies, of Bickerstaffe Hall, in the Southern Division, has also for the last two years tried some Shropshire Downs on his farm: they are a hardy and productive breed.

Horses.—Many horses are bred in Lancashire, and the farmers naturally have a taste for the practice; but, except in the western parts of the Southern Division already mentioned, they are not of a first-rate class, nor are they as good as they were a few years ago. There is a fair supply of good carriage-horses and hackneys for general work; at Over-sands, in the neighbourhood of Ulverstone and Furness, more high-bred horses are found than elsewhere. Mr. Kennedy, of Ulverstone, has by his enterprising exertions contributed greatly to raise the standard there; for this purpose he has brought down thorough-bred stallions from Col. Peel's and other racing studs for the season, and horses are sold out of this country at four years old for 80*l.*, 90*l.*, or 100*l.* a-piece. The depreciation of value alluded to above, especially in the agricultural horse, is owing to the little care and attention paid by the breeders to the mares, and the miserable parsimony which pervades their practice in this respect—" ex nihilo nihil fit;" and they seem to forget that it is impossible to breed a good and valuable foal out of a miserable and broken-down mare.

Pigs—Are generally good throughout the county; in this respect we are above the average of other better-farmed parts of England; the cottager always finds it an advantage to keep a pig, and it is very seldom that a bad one is seen. At Lathom there is a good breed of the small kind; Mr. Smithies has got some of the Berkshire breed, and crossed them with Mr. Hobbs's, which has produced a good stock and easily fattened. Mr. Billington, at Preston, has also some of Mr. Hobbs's breed. Mr. Swift, of Lowesbury, carried away two of the prizes given by the Royal North Lancashire Agricultural Society last September at Preston, for a boar and a sow.

Manures.—The most important manures used are lime, marl, sea-sand, bones, guano, ashes, town-dung, farm-yard dung, and compost of various kinds. *Lime* is used throughout the county almost universally, and is now mixed with salt, for moss cultivation; *marl* chiefly on peat and moss lands; *sea-sand* on the same kind of land near Cartmel. *Bones* are becoming very general, and are found most beneficial, both as a top-dressing to grass-lands, especially on the high grounds, and as a manure for turnips; but *guano* takes the precedence in this respect. From one end of the county to the other, from Holbeck to Halewood, this foreign manure seems to be valued most highly, especially mixed with farm-yard manure for turnips. On the Barton property, Mr. Logan, agent for Mr. Jacson, informed me that it had been applied largely and successfully: 2½ cwt. to the acre on meadow land in the first year, and half the quantity the second, has produced in both years double the quantity of hay that could otherwise be grown. For turnips 3 cwt. or 3½ cwt. per acre is necessary, but a less quantity, mixed with farm-yard manure, is found to answer better than anything. The guano first stimulates, and the manure sustains or feeds the plant. Messrs. Myers and Co. have kindly given me the following return of imports of Peruvian guano into Liverpool, viz.:—

1841	1140 Tons.
1842 1843	3307 „
1844	13,927 „
1845	11,151 „
1846	16,221 „
1847	21,482 „
1848	13,852 „
Total	81,080 Tons.

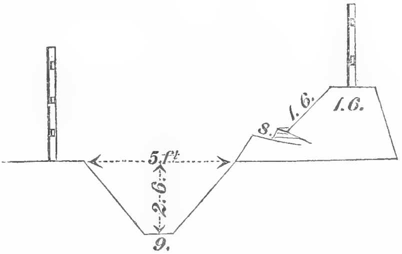
Besides this, great quantities from Africa have been imported by different people, and of course it is impossible to say how much has been sold for farming purposes in Lancashire, but there is no doubt that a very large quantity has been, and continues to be, used. *Town-manure* is by no means collected and made available as it might be; the difficulty of transporting it is the great obstacle to the use of it. If we were as careful in this matter as the Chinese, we should have in the large and numerous towns of this county mines of wealth from which the produce of the soil might be increased to more than double what it is. From Liverpool it is taken down by the Leeds and Liverpool Canal as far as Rufford, and from Manchester by the Bridgewater Canal to various parts of Cheshire, and to Stretford, Worsley, and Chatmoss in Lancashire, to the amount of 20,000 tons in a year, and the practice is greatly on the increase. The cost from Manchester, exclusive of cartage to and from the canal, is about two-thirds of a penny, or for short distances 1¼*d.* per ton per mile. It has recently been tried in a liquid state and applied to the land adjoining the canal by means of a hose—this experiment gives so far every reasonable prospect of a successful issue. Considerable quantities are taken to Chat-moss by the river Irwell, which flows to the south side of the moss, and the cost of transport is rather lighter than on the canal.

Irrigation.—This mode of improving grass lands has been little tried in this county, and when attempted, not on any extended or scientific plan. Mr. Dickson, in quoting from the "original Report" on this subject, says, "It is a matter of astonishment that so rich a source of improvement has been hitherto so much neglected;" and the same remark is still applicable.

In a country like this, where rivers and rivulets abound, there would be comparatively little difficulty or expense in throwing the fertilising streams on the land. Mr. Logan pointed out to me some meadow land in Barton which had been irrigated with very satisfactory results, when the land was under-drained previously; it had produced a double crop: and without under-draining, irrigation ought never to be thought of. In this instance, however, it is right to state that the irrigation was laid down scientifically, and at a *very considerable outlay*, by the late Mr. George Jacson.

Fences.—In the hilly districts a dry stone wall, without mortar, is the common fence, built about 6 feet high, to prevent the encroachments of the wild mountain sheep; yet such is their activity and rambling habits, that this is scarcely sufficient to stop them. In the low country the fences are professedly made of quick thorns, but almost invariably they are so badly managed, and so miserable, that they require thorough renovation. Mr. Lamb has within the last few years taken some pains to introduce good fences on the lower part of the Duke of Hamilton's estates, and these answer exceedingly well, a sufficient proof that it is not the fault of the soil or climate that they are generally so wretched. About three miles of new thorn fences have been made during each of the last two years. The method and form are after the Scotch plan, and as follows:—

	Ft.	In.
Width of ditch at top .	5	0
Ditto at bottom	0	9
Depth of ditto . . .	2	6
Scaresment width . .	0	8
Soil for thorn bed . .	0	4
Height from scaresment to top of back . .	1	6
Inclination of slope one inch in one.		
Width of top of backing	1	6



With posts and railing of two bars on the top of the backing, and post, with three bars on the field side of the ditch, the cost of the frame is as follows:—

	s.	d.
Three heights of rails and posts, and putting up, per rood of 7 yards	2	6½
Two ditto ditto . . .	1	6½
Thorns and beaches, say 54 per rood . .	0	7
Planting and making ditch according to subsoil, varying from 1*s.* to 1*s.* 4*d.*, say average . .	1	2
Total per rood of 7 yards . .	5	10½

The yearly cost of cleaning thorns is from a half-penny to three farthings per rood for the first five years. Cutting with a Scotch knife attached to a handle three feet long, costs from a farthing to three farthings per rood, if done by a man accustomed to the work; and this plan has produced good fences at five years' growth. When the posts and rails are removed, by laying a drain in the bottom of the ditch, the plough may go close to the fence. The greater part of the old hedges are very irregular, and occupy a space of four or five yards, with a ditch on both sides of the fence; and where land is divided into small fields, as in Lancashire, the acres that are lost by this old system must be very considerable.

Implements.—The use of good agricultural implements has been rapidly increasing during the last few years; Finlayson's cultivator, and a turnip-drill for sowing two drills at once, introduced from Berwickshire, are in common use in the neighbourhood of Lancaster; and within the last few years there have been between thirty and forty thrashing-machines worked by horses set up in the same district. These are also brought from Scotland, and cost about 40*l.* The Norwegian harrow, Crosskill's clod-crusher, Ducies's drag, with various grubbers and cultivators, and drills for seed, I have met with on the farms of gentlemen and large farmers, such as Mr. Patterson of Holbeck, and Mr. Smithies of Bickerstaffe, but many of these are too costly for general use.* The one-horse carts which prevail throughout the county are very good, and the iron ploughs are generally superseding the wooden ones. On the cheese-farms the old stone weights are making way for the iron lever-presses, and there is throughout the county a general improvement in this respect. The small moveable tram-road used by Mr. R. Neilson, Mr. Wilson Ffrance, and the Rev. W. Hornby of St. Michael's, is on level land a very valuable acquisition to the farmyard, and in our wet climate the greatest convenience in getting turnips off the land. The railway, which consists of a light bar of iron placed longitudinally on wood, in pieces of 16 feet in length, costs complete, about 11*s.* 6*d.* per piece, and the waggons about 3*l.* 10*s.*, but this of course depends upon the price of iron and timber. It is some credit to the mechanical genius, now first applied to agriculture in this county, that at York the prize tile-machine for making draining pipes was the production of a Lancashire workshop.†

In the art of *Reclaiming and Cultivating Waste Lands*, no doubt "much has been done, but more remains to do." Besides the mosses and high lands of the county, which, as we have seen, are gradually changing their barren nature into fruitful soils, there exist also large tracts of land by the sea-coast, which at present form part of the shore, that might, by embankments, be recovered from the sea.

In the year 1820 Mr. Edward Dawson of Aldcliffe Hall, near Lancaster, received from the Society of Arts their large gold

---

* The former gentleman has used for the first time this season Garrett's Corn-Drill, which he considers a very excellent implement. In a short note addressed to me on the subject, he says, "We only use two-thirds of the seed which is used in broadcast, and our crops look *remarkably promising.*"—*June* 2.

† See Report of Implements at the York Meeting, 1848. Journal of the Royal Agricultural Society.

medal for embanking 166 acres of marsh land near the mouth of the river Lune; the particulars of the method adopted are given in the Society's Transactions, vol. xxxix., No. vii. p. 33. This reclaimed land has produced luxuriant crops, and there is no doubt that land of this description would amply repay the required outlay: after allowing 5 per cent. on the money expended in enclosing Aldcliffe Marsh, each acre pays 25*s.*, the former rental being 2*s.* 6*d.* If Cockerham, Pilling, and Thurnham sands were enclosed, on the lowest calculation 5000 acres, at present worth little or nothing per acre, would by an outlay of 14*s.* or 15*s.* per acre be made worth a yearly rental of 5500*l.*

In the year 1838 an extensive project was formed for the enclosure of 46,000 acres in Morecambe Bay: the intention was to cross the bay by a railway, but the Commissioners of Railways, being directed to compare the line with one by Kendal to Carlisle, reported in favour of the latter, on account of its being more direct, giving no opinion upon the work of enclosing the Bay, which, however, by engineers, is considered perfectly feasible.

Of late years science has been directed to the great scheme of international communication by railways, which have absorbed the surplus funds of the country; but as these extensive works approach their completion, it is to be hoped that public attention will be turned to such undertakings as the enclosure of the Bay of Morecambe, and for which the coast of Lancashire seems distinguished by peculiar advantages, as it is estimated that more than 80,000 acres might be reclaimed to the north of the river Wyre.

In other parts of the county no great alteration can be effected in the produce without a thorough system of drainage, and that the landowners and farmers are now really becoming aware of the importance of this first step is clearly proved by the many tileries which have sprung up during the last few years. There are now in

The Southern Division.

Tile-kilns belonging to	Sir T. G. Hesketh, Bart.,	Mawdesley.
	Mr. Holland	Farrington.
	Mr. Fazackerly	Lathom.
	Mr. Hargreaves	Broadoak, near Accrington.
	The Earl of Ellesmere	Worsley.
	Mr. Hoghton	Bold.
	Mr. Whalley	Chorley.
	Mr. Chaffer	Burnley.
	Mr. Doulton and Co.	St. Helens.
	(Name unknown)	Oswaldtwistle.
	Col. Rawstorne	Pennwortham.
	Mr. Hatton	Moss Hawk Hall.
	&c. &c.	

In the Middle Division.

Tile-kilns belonging to	Mr. Clifton (2)	Lytham.
	Mr. C. R. Jacson	Barton.
	Mr. W. Garnett	Bleasdale.
	Mr. Hull	Whittingham.
	Mr. Wilson Ffrance	Rawcliffe.
	The Duke of Hamilton,	Cabas.
	Mr. Threlfall	Hollowforth.
	Mr. Edmondson	Caton..

In the Northern Division.

The Earl of Burlington (2)	Furness.
Other parties (2)	Furness.

But draining requires great care in the work, and a perfect knowledge of the circumstances of soil, subsoil, springs, &c., and the points suggested by Mr. Bullock Webster on this subject cannot be too well known. The following are a few of the most important, taken from a short letter addressed to the editor of the 'Ayrshire Agriculturist:'—

"1. No general rule can be laid down.

"2. Any one system for all soils is an absurdity.

"3. Depth and distance of drains must depend on the nature of the soil and subsoil.

"9. That grass land can be over-drained.

"10. The direction the drains should be laid must be governed by the strata to be cut through, the fall, and other local circumstances; the rule of going always with the fall is decidedly wrong.

"11. There are instances (in the new red sandstone) where drains will act perfectly at 40 yards apart; and there are strong clay subsoils that require drains every 6 or 8 yards.

"15. On the strong clay subsoils (not surcharged with under-water) drains 30 to 36 inches deep, at moderate intervals, are much more effective than deep drains at wide intervals, and on these soils the clay should not be filled in over the tiles or pipes.

"17. It often happens that drains 4 feet deep and 40 feet apart are placed over a field, when one drain properly put in would cure the whole."

Nothing has been so fatal to the progress of agricultural improvement as the dogmatical assertion of the absolute necessity of conforming to or adopting *one* practice, as the only good one, in all cases and under all circumstances. The real thing to be studied is, how best to make those circumstances available which are within reach, and not to abandon the hope of success, or the effort to obtain it, because the same facilities which have enabled our neighbours to be successful are not within the compass of our grasp.

As auxiliaries towards the advance of agriculture and the full development of the resources of the county, the railways must not be forgotten; they are extending gradually like a network over the face of the county, especially in the Southern Division, affording facilities before unknown in the transport of produce and manure, and are effecting a revolution in this respect, which is very important to the farmers. In many parts of Cheshire, where formerly cheese was made, the milk is now taken at once by the railways to Manchester and Liverpool, and the effect of this is, that the cheese-merchants come down into the north to look for that supply which formerly they obtained from the neighbouring county. This has given a new stimulus to the dairy-farmers; and I have been informed by a leading cheese-factor at Lancaster that, during the last few years, the cheeses in the northern districts have in fact improved wonderfully, and that now much more care is paid both to the making and the keeping of them. All this tends to confirm the opinion which prevails amongst many of the most influential practical farmers of the county, that the dairy and the cheese-room must be the chief objects which all our agricultural improvements ought to have in view.

The Agricultural Societies also deserve a special notice. Within the last few years the spirit of inquiry and desire to obtain really useful and practical information on farming matters has extended throughout this county, in common with the rest of the kingdom: we are, in fact, in a transition state, in which every advance in the right direction not only leads to positive improvement, but affords encouragement to further exertions—"vires acquirit eundo." The different agricultural societies which have been established in various parts of the county within the last twelve or thirteen years, are a proof of the vitality of this spirit of improvement. They were, in fact, the waking efforts of a people shaking off their lethargy; and though they may not perhaps have entirely answered the expectations of the founders, they have not been unproductive of good. A few years ago every town, especially in the northern districts, had its agricultural society. Ulverstone, Lancaster, Preston, and Blackburn vied with each other in their autumnal exhibitions, whilst the private societies of the Duke of Hamilton, Mr. Clifton, and Mr. Ffarrington occupied the rural districts. Some of these have now disappeared, and others are amalgamated with their more powerful though younger rival, the Royal North Lancashire Agricultural Society. The same change has been taking place in the Southern Division; and Liverpool and Manchester, instead of having each their separate society, are now united in one. The principle of these large societies is, that they should be perambulatory, like the Royal Agricultural Society of England. It is hoped that by visiting in succession the different districts and important places within their several limits, they will bring within the reach of every farmer, at stated intervals of time, a show of stock and implements such as no local society could possibly present to him; and also, which is very important, afford him the opportunity of meeting with gentlemen famed throughout England for their science and practice, and hearing from them, in the shape of friendly discussions or lectures, their opinions and the results of their experience.

In education we are still very deficient, and also in capital amongst the tenant-farmers: both the means and the knowledge how to apply those means to the best advantage in the cultivation of the land are wanting in Lancashire. This fact has such an intimate relation with the whole subject of leases and agreements between landlords and tenants, that it is impossible to enter fully into all the bearings of this most important question without taking it into account.

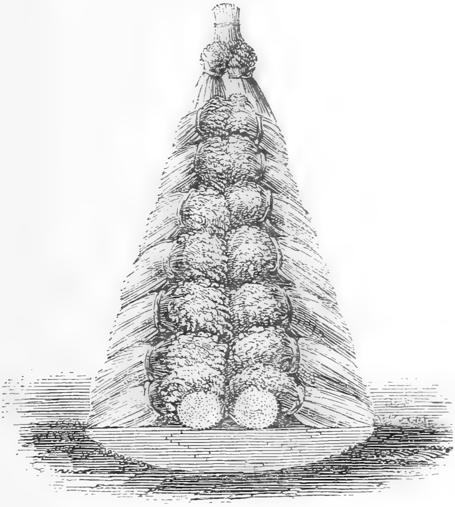
Lord Stanley, when presiding at Lancaster, in October, 1847, over the first meeting of the Royal North Lancashire Society, placed the matter in its true light as regards this county, and I hope I may be excused if I refer to his Lordship's speech on that occasion. His Lordship is reported to have said—

> "With respect to the arrangements between landlords and tenants, if they were not based on the strong ties and feelings of mutual confidence, he should then not hesitate to recommend that the holding should be secured by a lease, rather than by tenancy-at will; because although tenancies may be conducted in a manner that shall be satisfactory to both parties, leases give advantages which cannot otherwise be bargained or stipulated for. The conditions and durations of leases must necessarily vary under different circumstances, according to the condition in which the farm may be at the time of taking it; but if, as he had before said, the agreements between landlords and tenants may be considered based on the strong ties and feelings of mutual confidence, he thought there was little advantage in leases over tenancies. If the outlay for improving the farm has to be made by the tenant, then he should by all means be unrestricted, and allowed to receive the full and complete benefit for all his outlay; and at the end of the term, if a tenant had so honourably performed his part, the landlord would be unworthy the name of a man if he did not give such tenant preference over strangers, and on terms more liberal than would be proposed to any other applicant. If it should happen that a great outlay was required, the capital should be advanced by the landlord, and the tenant charged a reasonable interest upon it."

The establishment of Agricultural Schools and Farmers' Clubs would tend more directly than anything else to raise the standard of education; and, when anything of the kind has been attempted, it is gratifying to find that the advantages are soon appreciated.

The Earl of Burlington has founded a farmers' club at Dalton, which works well; and Mr. Wilson Ffrance, at Rawcliffe, has also tried the same thing on a small scale, which promises to lead to greater things. In both these instances that I have met with, a small circulating library, composed of elementary works on agriculture and agricultural chemistry, and others likely to interest a farmer, has been formed, and the books are lent out on certain simple conditions; they are read with great willingness, not to say avidity, and the success of these first steps affords encouragement to further progress in this most desirable direction.

The farm-labourers of this county are as well off, and perhaps better than in any other part of the kingdom, except where manufactures are found, as in Yorkshire, &c., and their cottages for the most part comfortable and substantial. Fuel is cheap everywhere, whether it be coals or turf, and an able-bodied man can earn 12*s.* or 13*s.* per week in any district. Mr. Patterson, of Holbeck, gives his men 7*s.* a week and their meat in the house, and Mr. Wilson, of Newton Park, has some in the house altogether; but this is not a good system, nor does it generally prevail. As a class, I should say they were better housed, better fed, better warmed, and better paid than in many parts of England where agricultural occupations are their only employment.



The section of a "Corn-Mow."

February 28, 1849.

To Mr. Garnett.

My dear Sir,—I regret that I was from home when you called here on the subject of your Report of the Farming of Lancashire; but I now send you the particulars of the process of working the field you saw in turnips last week—a process which several years' experience induces me to recommend as the best and quickest mode of bringing heavy, worn-out land into good play.

The field consisted of many small fields which I laid together, as my landlord desired.

Having all been for several years overcropped, under-manured, and short weeded, or rather never weeded, I had all to do. I commenced by carting upon the stubble, in autumn, 40 tons by weight of good farm-yard manure to the statute acre, and ploughing it in broadcast about 6 inches deep. I then cross-ploughed it with a four-horse plough 12 inches deep, and subsoiled 6 inches below that. A portion was sown with winter-vetches; the remainder was exposed to the action of the winter frost. Early in spring two other portions were sown with spring vetches, at different periods. The portion unsown was then well worked, weeded of twitch, &c., ridged up, bow-harrowed, sown with 1 cwt. of a compost of sulphurized bones, guano, and charcoal, or wood-ashes, ridged up again, so that the compost would form the seed-bed, rolled, and sown with turnips, which you saw growing well. As the vetches are cut off, the land will be transplanted with swede turnips, which may be safely done as late as the middle of July. For work of this kind good implements are essentially necessary, and I have derived the greatest benefit from Crosskill's clodcrusher and Stretton's Norway harrow, both equally valuable, the one on dry, and the other on damp land. I have also derived much advantage from watering the seed-bed, or the young plants, with weak manure-water, so as to stimulate it through the attacks of the fly; and I have given to Mr. Crosskill the model of a very simple and cheap contrivance, by which two boys can water four drills at a time, by means of a spout and four Indian-rubber tubes attached to a common water-cart. If the water is near the field, they may apply it, with one horse and cart, to about six acres per day. During the period of the fly I also used, with much success, a straw brush, which passes over four drills at once—a light pole about 11 feet long, with a small wheel at each end. The pole is lapped with straw, which trails along the tops of the furrows, and disturbs the fly. It does not destroy the fly; but the chances are hundreds to one that the same leaf is not again attacked during that day; and a boy and light horse or pony can go twice over 10 acres in a day with ease.

Many experiments and close observation of the result have convinced me of the value of this simple contrivance.

As my system of transplanting is different from any other, and has been very successful, I will give you the particulars.

I prepare a bed, and sow it early in rows about 8 inches apart, and thin out to 4 or 5 inches in the row. An acre will thus transplant about 20 or 25 acres.

As the vetches are mowed off, the space cleared is ploughed, well worked, dressed with 2 cwt. of the compost, and ridged up. As this work proceeds the plants are being prepared, and are planted while each drill is damp and fresh. As dispatch is only produced by division of labour, the process is as follows:—One party, No. 1, pulls the best plants, keeping them "heads and tails," and carries them to another party, No. 2, who sits at the end of the ground to be planted, and who nips off the slender part of the tap-root and the upper part of the leaves, laying them in a basket, also "heads and tails;" No. 3 carries them up the field to No. 4, who lays them in the drill, with the leaves towards the planter's left hand; No. 5, who must be a man or boy, that, striding across the drills, no petticoats may interfere with the plants just put in. I never use the dibbling-stick, which, in heavy land, only hardens the inside of the hole, but the planter is furnished with a light, hollow, half-round steel trowel, with which, in his right hand, he lifts up a portion of soil, while with his left he puts the plant in a slanting direction below it; then drawing back the trowel, the soil falls loosely on the plant, and a short stride of one leg takes him to the next.

The proportion of labour for pulling and topping depends on the size and position of the plants; but one layer will do for two ordinarily quick planters, though my bailiff, whom you saw, can transplant a statute acre in the day. I usually transplant from 15 to 30 acres per annum, and have raised, according to the examination of the Inspector of the Liverpool Agricultural Society, 26 tons 4 cwt. per acre; but the land must be "mucked heavily, ploughed deep, and weeded clean," which I consider now, more than ever, the farmer's motto.

You allude in your Report to my invention of a portable railway, which, I assure you, is a most valuable implement. I sent a model the other day to His Grace the Duke of Richmond, for the Entailed Estate Improvement Committee of the House of Lords, and the railway may be got at a very reasonable cost from Mr. Crosskill of Beverly. By it I remove the whole of my green crops without the least injury to the land; and last autumn I put 127 tons of manure on 3 acres of land, lying from 220 to 400 yards from the manure-heap, at a cost in labour of 23*s*.

I can only repeat my regret that I did not see you on your visit to my farm, when I would have shown you the *modus operandi* of these different implements, and which I shall be happy to do on any future occasion.

Yours, &c.,

Halewood, June 2, 1849. ROBERT NEILSON.

II.—*On a Dress for Drainers.* From the MARQUIS of WESTMINSTER.

To Mr. Pusey, M.P.

DEAR MR. PUSEY,—I mentioned to you last summer a plan we adopt to protect our drainers, when working in a narrow trench to the depth of 3 or 4 feet, from the moisture with which their clothes are saturated and their skin soaked for the day, while exposed to cold and damp, by which rheumatism and its attendant evils are entailed.

The plan being one which the labourers readily take to, and from which they derive obvious comfort, I wish to recall your attention to the subject, giving you the result of what I have tried for some years with success, and of which others may perhaps approve.

We supply our labourers with a sort of leathern trowsers, which protect the hips and legs from coming in contact with the wet clay. These leggings are used only by the man who digs the last narrow spit and scoops out the lowest soil from the trench before fixing the pipe. In bending forwards, his shoulders also are brought into contact with the upper sides of the wet trench, to guard them from which a pair of leathern armlets are most useful. These armlets, as well as the leggings, are put on and taken off with perfect facility, are so far pliable as to create no impediment to the action of the labourer, fit sufficiently close not to rub against the sides of the trench, or make it crumble, and effectually keep out the wet for the entire day. They are easily rolled up and carried to and from the place of work.

The leggings are formed of ordinary leather, in two pieces detached from each other, about 40 inches in length, and 18 inches wide at the top for the waist; 20 inches a little lower down, allowing a sweep for the haunches; and 15 inches at the ankle. One strap is placed on the front and one on the back of the top belt of the right legging; and corresponding buckles on the left legging, to fasten them up round the waist. Three buckles are placed on the lower part of the straight front of each legging, with three straps behind, just below the sweep, expanding round the haunches; which expansion may be restrained, if thought necessary, from sticking out, by another buckle and strap behind, a little below the belt-strap. The straps and buckles being drawn together round the leg, form the trowser or legging, one being above the knee and two below it.

The armlets are also formed in two pieces of rather lighter leather, 30 inches in length, 13 inches wide round the shoulder, 8 inches at the wrist; a strap and buckle to surround the wrist, the same just above the elbow, and the same to unite the two separate pieces of leather across the back; a piece of webbing on each side to tie loosely across the chest, to keep the armlets in their place. The leather is scooped inwards at the top, not to interfere with the face and neck.

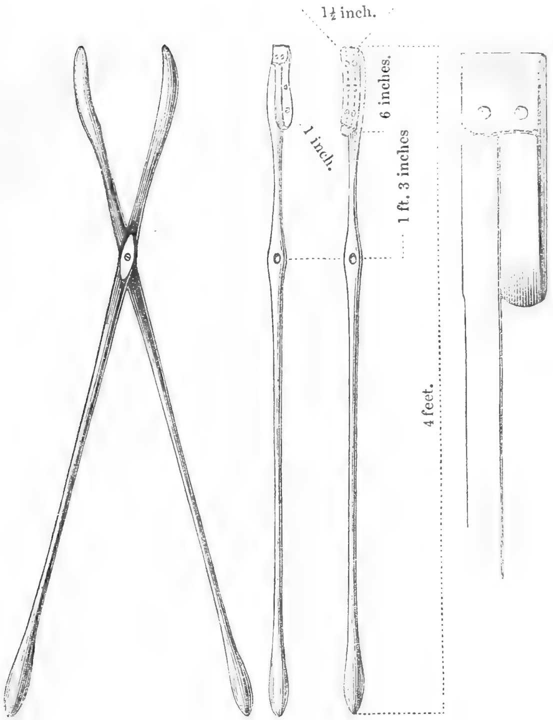
For placing the pipes in their bed we use a pair of nippers made by our own workmen. The handles, which are of oak, play on an iron pivot—and, where this pivot works, are 1½ and 1 inch thick, but are gradually reduced both ways for lightness, and slightly bulge at the hand-end for convenience in holding. The additional breadth of the parts that clutch the tile is gained by screwing on another piece of wood with two screws, which is additionally secured by the screws of a roughed iron plate (not one-eighth of an inch thick) with which those parts are faced, and which is turned over the end and screwed again with two screws at the back. The advantage of this tool is, that the drainer can handle the tile readily, in whatever position he may find it, and place it firmly in its bed, without of course having to descend himself into the narrow scooped channel prepared for the reception of the tile only.

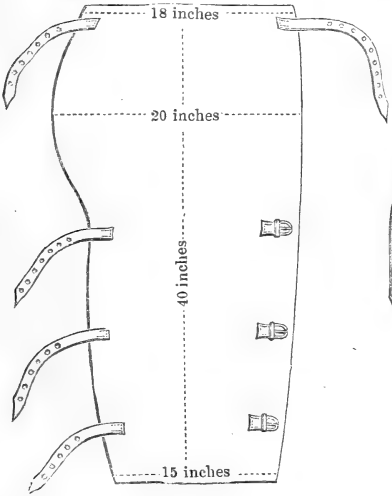
The draining leggings cost, the pair, about 20*s.*, the armlets 10*s.*, the tile-nippers 7*s.* 6*d.*

I send a pattern pair of trowsers and armlets, and nippers, with a sketch of each, to the Agricultural Society's office, for any one who may have the curiosity to look at them.

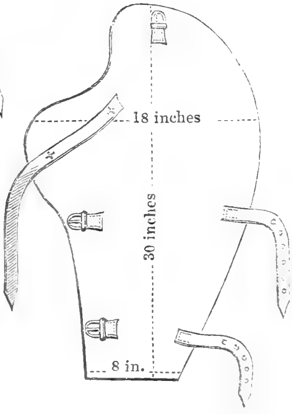
Believe me, my dear Mr. Pusey,
Very truly yours,
WESTMINSTER.

Motcombe House, Shaftesbury, 20*th Feb.* 1849.





RIGHT LEG.



RIGHT ARM.

The measurements given are full size.

The left leg should of course have 2 buckles instead of 2 straps at the top, and the left arm a strap. ×× is a piece of webbing, fastened to each arm, which cross like braces, and are tied on in front.

III.—*On the Giant Sainfoin.* By THOMAS HINE.

THE GIANT SAINFOIN, as it has been styled by Mr. Hart, of Ashwell, Herts, the fortunate introducer thereof, was totally unknown in this neighbourhood until about twenty years ago. It was then, on Mr. Hart's inquiring in the market for Sainfoin seed, that he was apprised by the late Mr. Carrington, of Shefford, Beds, that he had twenty bushels of old seed he was at liberty to try; for which, if it did not grow, he would make no charge. These terms being accepted, the seed was sown, but, owing to its being late in the season and a dry summer following, it did not vegetate until the autumn, but in the spring it became vigorous and strong, and turned out to be a distinct species of the plant, possessing such peculiar properties, as will go far ultimately to supersede the growth of the common stock, unless it be upon some of the very poorest of our soils, where it is sown for purposes for which the Giant species would be unsuitable, and to which I may hereafter advert.

The crop thus obtained was mown for hay in the usual way: but Mr. Hart was surprised to find, that about six weeks after it presented him with another crop, in full flower. This also was mown for hay; but in September it came again into flower, and again was cut for hay. The same fertility in its growth occurred in the second year, and with the same results, save that it excited the wonder of the neighbourhood, and was the subject of general discussion. This led Mr. H. the third year of its being in plant to suffer the second crop to go to seed, which, with all the stock since produced therefrom, has possessed the same peculiar properties; and a desire being evidenced by many parties to procure the stock, Mr. H. was enabled to dispose of his seed for many years at prices varying from 50*s*. to 80*s*. per bushel.

Although residing in the immediate neighbourhood where it was introduced, and a large grower of Sainfoin, I must confess that I was rather sceptical as to its being so decidedly superior to the common stock, as to justify the enormous price demanded for the seed; at length, however, by repeated examinations of the plant in its different stages for two or three years, I became fully alive to its important properties, and determined to possess myself thereof: I did so, and my success and disappointment I shall proceed to detail.

Having obtained two bushels of seed, I sowed it in July upon land which had been prepared for turnips, and obtained a fair plant; but the fly made such ravages thereon, that I was reluctantly compelled to plough it up. My next effort was made in the month of March following, by obtaining from Mr. Hart 4 bushels of seed, for which I paid him 80*s*. per bushel; and, being anxious to make the seed go as far as I could, I planted it by dibbling between the rows of wheat drilled in the autumn upon a pea stubble, which had been previously well prepared in reference to this object. My reason at this time for selecting a wheat crop upon a pea stubble was, because I thought I could depend upon such crop not injuring the plant; whereas I felt that, with no other crop upon the farm, I should be perfectly safe should a dripping summer ensue. The enormous price I paid for the seed induced me to use this precaution. I have, however, subsequently discovered other reasons which have induced me to continue the practice. Wishing to cover as much ground as I could with my seed, I set six droppers to follow one man, that only one seed should be put in each hole, making them as close as possible. In this way I succeeded in making the 4 bushels of seed reach over more than 2½ acres of ground. The seed planted well; and although the plant was thin, yet, having left the stubble to protect the plant during the winter months, it rallied early in the spring, and, by the first week in June, I could have cut 35 cwt. of hay per acre; but, thinking I could obtain two crops of seed in one year, I left it for that purpose, cutting it in July; but the plant being thin, it branched out considerably, which retarded the flowering, and, consequently, the maturing of the seed, so that only a scanty crop was realized; and the second crop, although it went to seed, was late in October before it attained anything like maturity, and a frost causing the seed to fall, the crop was a total failure. By falling into this error I sustained a heavy loss. The 2½ acres as a maiden crop produced me only 19 bushels of seed; whereas had I mowed the first crop for hay, and the second for seed in August, there would have been more uniformity in its ripening, and I have no doubt, from crops I saw treated in that way, but I should have obtained 40 bushels of seed, so that, when the loss of the hay crop was also taken into account, my loss by this injudicious step amounted to about 90*l*., as some of my neighbours obtained 80*s*. per bushel this season for their seed. The next season I was more successful, and in June cut about 40 cwt. of hay per acre, and in August obtained about 20 bushels of seed per acre.

Wishing, however, to notice my failure as well as my success, I proceed to state that the next season I procured another 4 bushels of seed, at 70*s*. per bushel, which I planted by dibbling with Tartarian oats, sown thinly, but very early. The seed was put in precisely the same as with the wheat crop of the preceding year, but it never planted so well, and the oats being heavy, the Sainfoin was only a partial crop; still, however, I suffered it to remain three years in plant, and the price of the seed ruling high during the whole period, it was, upon the whole, a profitable crop.

I now feel myself bound in all fairness to notice an unfortunate occurrence which took place in 1844. Having determined to sow all the seed of my own growth until I had obtained the breadth I usually grew entirely of this stock, I sowed all my stock of seed, for which I could have obtained 70*l.*, by drilling between the rows of corn, which proved an entire failure, owing to the excessive drought of that summer. But herein I was not singular, as I know of no party who obtained a plant in that season. The clovers, also, were generally affected in a similar way, only 6 acres out of 70 acres I sowed realizing a plant.

Having by this time, from my own observation, discovered the peculiar properties of this species of the plant, I shall proceed to detail them, and, with a view to make myself more clearly understood, I shall do so principally by showing in what respects it stands contradistinguished from the common stock. There is very little difference in the appearance of the two varieties, but it is generally a shade darker in its colour, is more rapid in its growth in the spring, and still more so after the first cutting, which, in this locality, generally takes place very early in June; after this it shoots much earlier and grows much faster than the common stock, and by the end of July will be again in full flower. The bulk of the second crop will mainly depend upon the state of the weather. Upon whatever soil it is planted, it will always be much more bulky in a moist season than in a dry one; still, however, be the season moist or dry, it will go to flower at the same time, and produce as much or more seed in a dry season than in a dripping one. If cut a second time for hay, it will be in flower a third time in September, but if left for seed, it will be ready for cutting in August, after which it will produce an eddish nearly equal to what is generally produced by the common stock after the first mowing. Again, the root of the Giant species is not so large as that of the common stock, roots of which I have sometimes known to penetrate upon a chalky soil to the depth of four or five feet, being proportionably large, but the roots of the Giant species are much smaller. The stalk, also, will be larger and taller, especially the first year it is in plant; the reason of this is, its maturing itself much sooner than the common stock. The stalk, it is true, will possess a greater cavity in the middle, and, as a matter of course, will flatten more in the hay stack; but whether this is advantageous or not I really cannot take upon myself to determine. With regard to its nutritious qualities I have no knowledge; but I have known that when both species have been sown side by side and depastured, the stock have given a decided preference to the Giant species; this, moreover, is corroborated by the observations of some highly respectable individuals, whose testimonials will accompany these remarks. I have also known where a party grew a small quantity, and placed it in the middle of a large stack of the common stock, that the horses gave a decided preference to the few cakes of the Giant species, whenever it was arrived at in cutting down. I have also clear proof that the fodder arising therefrom, when it is cut for seed, is superior to that produced by the common stock, when each is equally well gotten.

But before I leave the subject of the peculiar properties of this species, I must remark, that it matures itself much quicker than the common stock, which never attains full perfection before the second, or, in some cases, the third year after it is in plant; but I have known the Giant species produce, upon a chalky soil, 2 tons of hay per acre the first season it was in plant. Still, however, I have never yet known a crop of this species but what produced a greater bulk in the second than in the first year of its growth, provided the season was equally favourable. I have also known seed sown in April, without the intervention of a crop of corn, produce a most abundant crop of hay the same year; and some sown at the same time produce seed in September. It must be admitted in each case that the land was good and in high condition; a crop of turnips having been previously fed off. There is also a crop now growing upon land of a heavy character, well drained, which was sown in February last with oats, which was not only cut with the oats, but has since then produced another crop, which was used for soiling the working horses upon a large farm. I shall now close my remarks upon the merits of the two species (except so far as an observation or two may be necessary in my further remarks) with this important fact, viz. :—I have frequently known the two species tested side by side, but never, within the period I have recommended it should be continued in plant, an instance wherein the decided superiority of the Giant species was not clearly apparent; and from others, who in different parts have tested them in a similar way, I have received communications giving the most unequivocal testimony of the same results attending their experiments.

Having, as before stated, suffered much from a failure, or partial failure, of the plant, I began most assiduously to inquire what would be the best method to adopt, in order to ensure success in this particular. And here I would acknowledge the obligations I am under to a gentleman from Berkshire, detailing the success which generally attended the cultivation of Sainfoin in a crop of wheat, which practice I was at first induced to adopt from such recommendation, without ever satisfying myself as to the ground or reason of such success. And perhaps it may not be altogether uninteresting to my readers, if I briefly detail the circumstances which have caused me, step by step, to arrive at my present conclusions thereupon.

For upwards of twenty years I had invariably adopted the practice generally had recourse to in the neighbourhood, of sowing the seed with a crop of barley or oats, sown after turnips, where the land had been previously well cleaned and cultivated as a preparation for the crop, and sowing not more than half, or at most two-thirds, of the quantity of corn, lest it should grow too large and endanger the plant of Sainfoin, which would of course prove a greater loss than a partial defection of the corn crop, as it would extend itself over the number of years the Sainfoin remained in plant. But even with this precaution, I have known, in seasons of great drought, that the plant has been so far destroyed as to render it unfit for the purpose for which it was sown. To obtain a greater certainty in procuring a plant without any loss in the preceding crop, is what I have been aiming at for the last ten years; with what success I shall proceed to detail.

From experience I have proved that land, to ensure success in planting this crop, should possess a friable surface, and solidity in the soil immediately below the surface: without the former you cannot obtain a plant; and without the latter, although a plant may be obtained, in a season of excessive drought it cannot be retained. It is essential for the reception of the first roots; for however fine the mould may be at the surface, if there be no solidity, the drought, if long continued, will destroy the plant; but with both these pre-requisites I have never yet known a failure. The question then naturally presents itself, Is this preparation generally found in the ordinary course of cultivation upon a farm? If not, you must either abandon the cultivation, or undertake it upon a risk; for I hold it would be altogether unadvisable to cultivate expressly to meet the requirements of a plant which is only intended as an auxiliary to a profitable system. There will, however, be no difficulty as to this; for upon land in a perfectly clean state, sown with wheat the preceding autumn, whatever may have been its previous course of cropping—except it be a clover layer, which I should not recommend—you will in the spring find all that is necessary to ensure success in obtaining a plant. I have seen most excellent crops of Sainfoin produced in this way: in some cases by drilling the seed between the rows of wheat, in others across them; and also in a crop of wheat sown broadcast. I should, however, in either case, recommend that the seed should be deposited with a drill, by which means it is better covered at one uniform depth, and a considerable saving of seed is effected: from two and a half to three bushels of seed per acre being amply sufficient, when sown in this way, upon land as above described. Nor is this all; it is clear to me that the plant will mature itself sooner in this way than with a spring crop, unless the season should prove more than ordinarily favourable for a crop sown with spring corn. There will also be no loss with the corn crop. I have repeatedly known excellent crops of the Giant Sainfoin producing, by the first week in June, from 35 to 40 cwt. of hay per acre, upon land which had produced 4, 4½, and in one instance 5 quarters of wheat the preceding year. I am aware that the introducer of the Giant species recommends that it should be sown upon land in high condition, without a crop in the spring; that some superior crops have been obtained in this way, and that sometimes a crop of hay or seed has been produced in the summer or autumn, upon land sown the preceding spring; but this is a practice which will never be generally adopted.

I have been thus particular in detailing the results of my experience as to the cultivation of Sainfoin in a wheat crop, not with a view to condemn a different practice, where such practice has for any length of time been successfully adopted; on the contrary, I should advise parties desirous of cultivating this species of the plant, to adopt the same course as they have known to be successful in their various localities in reference to the common sainfoin, the requirements for its cultivation being, in my opinion, (with one exception, to which I may hereafter advert,) precisely similar. Still, when it is evident that a more successful method is practised in another locality, I hold it to be the duty of enterprising characters to try it in their own, taking care to do so with caution.

I hold that man to be a novice, however valuable and extensive his acquirements may be, who, upon finding himself placed in a new locality, should forthwith fancy he has nothing to learn from his neighbours, who, with their forefathers, have from age to age been located upon that particular spot, and must therefore have had ample means of acquiring the knowledge necessary to successful cultivation. On the other hand, I should hold those parties to be anything but wise men who should wilfully shut their eyes to any experiment which a stranger but newly located among them might make, merely on account of its novelty.

Having fully explained what I have found to be the most successful method of securing a plant of Sainfoin, I proceed to show how the Giant species may be brought into profitable cultivation, in a general way, upon farms where the four-course system of cultivation is adopted, without any material disorganization of such system, and with such apparent success as, I flatter myself, will so commend itself to the intelligent cultivator of the soil, by the ample remuneration it must of necessity produce, as to bring it into general use upon all soils adapted to the cultivation of the plant. In doing this, I shall first give a brief outline of the system I recommend, and then show how far my own experience, and that of my neighbours, is corroborative of the advantages which will attend the system propounded.

I take it for granted that the system of sowing the whole of the barley shift with clover is no longer practised generally, from a conviction that half the shift, sown every eight years, will produce at least three-fourths as much food as can upon an average be produced from the whole of the shift sown every fourth year. When this plan is adopted, it will leave half the shift to be sown with some other crop. Here it is that I would commence operations: upon a part of this—say one-sixth of the entire shift—which I will suppose to be cropped with peas, and which, upon a farm of 100 acres, in each season will amount to about 17 acres; to this quantity, therefore, I should direct my attention so soon as the peas were harvested, and, by a little extra labour then, and during the period that elapsed before Michaelmas, I should take care to render the process of summer fallowing after the ensuing wheat crop perfectly unnecessary. This being done, I should, in the wheat crop, whether sown broadcast or in rows, deposit the seed with a drill in the spring. In that case, the land will present you with a crop of sainfoin in place of the turnip-crop. This may be mown early in June for hay, and again in August for seed, and it will then produce a fine eddish in October. This I should continue in plant a second year, when it would displace the barley crop, and again in the third year displacing the clover layer. I then propose that it should be taken up for wheat with the rest of the shift, when, in my opinion, it will with the same treatment produce the best crop the shift will afford. I am quite aware that the plant of sainfoin will not be exhausted; but, upon a sainfoin layer of four or five years' standing, the wireworm sometimes makes sad ravages in the ensuing wheat crop, and even in the turnips and barley that follow: when the plant has been taken up in full vigour, say at the end of three years, I have never known these disasters occur. My practical readers will perceive, that by pursuing this system, and planting another 17 acres in a similar way in the ensuing year, and another in the third year, a breadth of 50 acres may be appropriated each year to the growth of this valuable plant, without any sacrifice of corn-growing crops, save the 17 acres of barley in each year. From 50 acres of sainfoin thus produced, I calculate that from 80 to 100 tons of hay would be realized (in proportion to the productive powers of the soil) by the first mowing, which will for the most part be found sufficient for the entire consumption upon the whole farm, especially when the fodder arising from the 50 acres of seed in each year is taken into account, which last will be equal in quantity and value to from 30 to 40 tons of meadow hay, supposing each to be equally well gotten. By adopting this system, it follows that the whole of the clover upon the farm may be fed with sheep, except in such localities where a more successful mode of disposing thereof can be had recourse to. This practice, moreover, will meet one of the peculiar properties of this species, which is this:—I do not think it will remain in plant so long as the common stock; which, with its maturing itself so much earlier, and the extra mowing it undergoes, is not very surprising. Still I have known it answer well for five years, where most abundant crops of hay were produced in each year; but the seed crop of the last year was a failure, the seed dropping from the stem after it was set. In another instance, when it was sown upon a weak clay, well drained, in the middle of a 30-acre field of the common stock, and treated the same, by being mown once and then depastured, it remained in plant as long as the other was allowed to remain, being eight years.

I shall now proceed to show how my own experience and observation bear out the utility of the system I have laid down in theory. In 1845 I selected a field of 24 acres, which had been well manured in February, 1844, and sown partly with beans and partly with peas. The soil was a reddish loam, with a fair proportion of gravel stones, and the subsoil, at the depth of from 18 to 24 inches, was partly chalk and partly a dry white clay of a chalky character. This was all planted with wheat in the autumn: the sainfoin drilled between the rows in the spring, and the stubble left during winter to protect the plant. It has received no manure since that period, but has been mown once for hay and once for seed in every subsequent year; part was drilled at the rate of 2 bushels, part at 2½, and the remainder at 3 bushels per acre. The crop was all good, but I gave a decided preference to the *thickest sown.* The hay is not so coarse, and there are more stems to produce seed on the second mowing. The field having planted well, I am desirous of ascertaining how long it will continue in plant, being mown once for hay and once for seed in each year. The field planted in 1846 was prepared in a similar way, and although the wheat crop was splendid, and partially lodged, the sainfoin is very good, 3 bushels per acre having been sown. In 1847 a piece of exceeding poor chalk land was planted, after being prepared in a similar way; but, like all the sainfoins in this neighbourhood, being its first year in plant, it suffered in the spring from excessive wet weather, and the hay crop was not so productive as I usually grow, but has since been thrifty, and promises well for future years. The piece planted in 1848 was put in with wheat, sown partly after beans and partly after rape.

The wheat was much lodged, but not so long before harvest as to destroy the plant; and since then it has grown luxuriantly. The plants thus obtained in four consecutive years are looking healthy and strong; and when the regularity thereof is regarded in connection with the weight of the wheat crops in which they were respectively produced, to say the least of them, they go to prove that by planting the sainfoin with wheat, instead of a spring crop, you do away with the necessity of making a sacrifice in the crop, in order to ensure a future crop of sainfoin; as, in my opinion, a crop of wheat will rarely be found lodged to such an extent as to endanger the plant growing therein.

In further corroboration of my own experience, I may here be allowed to remark, that many of my friends and neighbours have adopted the system herein recommended, and at present I have never known a failure in obtaining a plant, although one party lost it when obtained in this way, through its having been eaten with slugs in the month of May.

The recommendation I have given for cultivating the Giant species in accordance with the four-course system of cultivation, has not been made without mature consideration; and perhaps I shall be excused if I proceed to state some two or three of the most important reasons which have led to this conviction. I have been more than forty years engaged in agricultural pursuits, which have been attended with a measure of success, and I have no hesitation in stating it as my opinion that the Giant species will be more remunerative to the cultivator thereof in *three* years than the common stock will in *five;* this will of course give two years more for the land to be appropriated to other purposes. But, besides this, after three years in full plant, you are certain of your crop of wheat, whereas after five years, to say the least, it is hazardous. Again, by adopting this practice no derangement is offered to the four-course system, while the land is appropriated without any extra expense to the growth of crops for three years, equal in value, upon an average, to any crops produced upon the farm, while they displace only one corn crop—the barley; all this is at less expense than would be incurred in the ordinary way. For instance, the crop of wheat will for the most part repay the additional expense in preparing the pea stubble for the reception of the sainfoin. The turnip crop, upon an average, will cost as much producing as it is worth, the barley crop will not equal the value of the sainfoin in the second year, nor will the layer displaced by the third crop be anything like the value of the sainfoin crop. Besides, on many farms peculiarly adapted to the growth of sainfoin, the occupiers depend upon the clover for all the hay necessary for general consumption, and mow a considerable proportion thereof for this purpose; but, by adopting this system to the extent required for hay, they avoid the necessity of repeating the clover too often.

Under any circumstances, I should not recommend more than half the hay and fodder arising from the sainfoin to be consumed in the yard; believing as I do that it may be more profitably applied by cutting it into chaff, and giving it to the sheep upon land with the turnips. Here the intelligent farmer will be best able to judge for himself in the selection of his stock. I keep breeding ewes, and winter my lambhogs, selling them in the spring, either fat or as stores, or keeping them during the early part of the summer upon the clover, as circumstances may require; but others, who wish to consume much cake and corn, may prefer keeping sheep wholly for fatting purposes. In either case, I am of opinion that the consuming value of the hay will generally be obtained, and a greater return to the land realized, than by consuming the whole in the yard. And in either case I am of opinion that the return to the land from the hay thus consumed thereupon is greater than would be effected by the value of such hay consumed in corn, in a similar way, in any year, and especially in a very dry summer, when corn consumed upon the land is sometimes injurious to the barley crop. When this practice is followed up year after year, much permanent improvement will be seen upon the farm, especially when such a practice is carried out merely as an auxiliary to a system heretofore working tolerably well.

In various letters respecting the Giant Sainfoin, I have met with such observations as this: "I think the generality of the land in this neighbourhood is too poor for it." Now I have known it answer well within a few miles of this place upon a chalky soil, where the land was only one remove from unprofitable cultivation. The land, indeed, was highly cultivated, but not more so than was profitable. If, in the remark above given, allusion was made to the system I know to be practised upon some exceedingly poor soils, of sowing the land with sainfoin, and when it is no longer remunerative for mowing, using it for a sheep-walk, I must confess, in that case, I do not think it is so well adapted, seeing, as before stated, it will lose plant sooner than the common species, unless it be treated as such species generally is, without regard to taxing its more productive powers. For my own part, I see no reason to doubt but that upon our weakest soils a crop of seed may be produced proportionate with the stamina such soils may possess. I would, however, adopt every possible method that I could reasonably expect to be remunerative, in order to increase the fertilizing powers of the soil previous to planting the sainfoin; and, although I have recommended a wheat crop upon a pea stubble to plant the crop of sainfoin upon, having found such a practice beneficial in its results, there is, nevertheless, a far better preparation to be made for both wheat and sainfoin upon weak soils, by large flock-masters, in the following manner:—by sowing Italian rye-grass, rye, or tares, as may be deemed most judicious, upon the barley stubble, so as to produce a sufficiency of green food for a flock of young lambs by the middle of April; they may then be placed thereon, and allowed to run before their dams in pens, giving them a fresh piece every day. The ewes following them may be kept upon mangold, reserved for that purpose, together with such dry food in the troughs as may be requisite to keep them in condition and enable them to suckle well. In this way they may be kept to the end of May, at some additional expense, it is true, but not more than the extra sheep kept will amply pay for, and the land, by being ploughed as the sheep pass over it, will be sufficiently pulverized, and in good condition to produce rape for early feeding, or, with the assistance of a small quantity of Lawes' manure (if required), early turnips, for September feeding, may be produced; these may be fed with corn or hay, as the land may require, when it will be in fine condition for a wheat crop and the sainfoin which follows it. I merely make these suggestions upon a practice which I have known to be successfully adopted upon a weak soil, as a preparation for the cultivation of the Giant Sainfoin.

Newnham, Baldock, Herts,
April 19, 1849.

The Testimonials subjoined are from parties who have tested the merits of the plant in different parts of the kingdom.

Ickleton, Cambs.

Sir,—I have only grown the Giant Sainfoin one year, but, from one year's trial, I shall certainly not think of growing any more of the common stock in future, as the crop of Hay mown from the Giant exceeded in weight that grown from the common stock by at least one-fifth; after which it was seeded, and the after-feed was then equal to that of the common sort after the hay-crop only.

The soil upon which mine is growing is a dry rubbly chalk.

I am, Sir, yours, &c.,
To Mr. Hine. Samuel Jonas.

Redbridge, near Southampton, Hants.

Sir,—The Giant Sainfoin has far exceeded my expectation, and fully deserves the high character you gave it when you sent the seed.

It was sown under very unfavourable circumstances, with a barley-crop, in March, 1847, upon a piece of our poorest land, the plough frequently running upon the hard gravel.

The barley, in parts, was much lodged, but the Sainfoin took no damage, and appeared very strong and vigorous in the autumn and during the winter, the severe frosts making no impression upon it.

Being planted by the side of a piece of clover, the rapidity of growth in comparison was remarkable in the spring of the year, and by the 26th of May it was ready for the scythe, when there was at least 30 cwt. of hay per acre. In a few weeks afterwards the crop was again knee high, and in good condition for stable-food or second crop of hay; but wishing to procure more seed, I allowed it to remain for that purpose, after which it produced herbage 7 or 8 inches high.

I certainly consider it a most valuable plant for agricultural purposes generally.

I am, Sir, yours, &c.,
To Mr. Hine. WILLIAM STRIDE.

West Hagbourne, Berks.

SIR,—In reply to your inquiries respecting the Giant Sainfoin, I beg to inform you that I succeeded very well.

The seed was drilled upon a light loam soil, with a crop of wheat, at the rate of 2 bushels per acre.

The first crop I mowed for horses, the second was seeded, and the third fed with sheep.

I certainly consider it far superior to the common stock.

I am, Sir, yours, &c.,
To Mr. Hine. J. LOUSLEY.

Molland, Ash, near Sandwich, Kent.

SIR,—In reply to yours respecting the Giant Sainfoin, I beg to state I sowed the three sacks of seed you sent me, upon 3½ acres of poor thin staple with a subsoil of chalk, in a crop of wheat, which in the spring was attacked with wire-worm, and the Sainfoin suffered considerably from the same cause; but though in consequence the plant was thin, it realized the next year a good crop for hay, and afterwards a crop of seed, with an aftermath about equal to that of the old stock after the hay-crop only.

I am therefore perfectly satisfied with the trial I have given it, and shall certainly recommend it to the notice of the Sainfoin growers in this neighbourhood.

I am, Sir, yours, &c.,
To Mr. Hine. AUSTEN GARDNER.

Lanark, near Weston, Herts.

SIR,—In reply to your inquiries respecting the Giant Sainfoin, I beg to state that I have grown it about ten years, and have always found its properties the same.

I have been an extensive cultivator of the common stock of Sainfoin, and have also grown Lucern for soiling for stock; but there is no doubt in my mind as to the superiority of the Giant Sainfoin to either, for any purpose, as it produces more weight per acre, and the quality is decidedly superior to Lucern, or any other green food I ever grew.

I have experimented upon it in a variety of ways, and do not hesitate to pronounce it a most valuable plant; and no one who knows its value as well as myself will for long remain without it.

I am, Sir, yours, &c.,
To Mr. Hine. JOSEPH BEAUMONT.

Clare Hall, Cambridge.

Sir,—In reply to your inquiries respecting my opinion of the Giant Sainfoin, I beg to state it has been cultivated upon my farms about eight years, partly upon chalk and partly upon heavy land, well drained, on both of which it has succeeded well; and I have no hesitation in stating it will produce more weight, whether as soiling for horses or for hay, than any other artificial grass of which I am aware.

I have kept it in plant five years, and others a longer period, where it has been more free from grass, and can speak to its superior qualities to the common stock, in whatever way it may be appropriated.

I am, Sir, yours, &c.,
To Mr. Hine. William Webb, D.D.

Royston, Cambridgeshire.

Sir,—The Giant Sainfoin is fast superseding the common variety in this neighbourhood.

Having watched its progress for many years, I think its merits cannot be questioned, when the extraordinary produce is known.

The small supply of seed, and consequent high price, are the only impediments in the way of driving the other sort out of cultivation.

I am, Sir, yours, &c.,
To Mr. Hine. Valentine Beldam.

Boarhunt, near Fareham, Hants.

Sir,—In reply to yours respecting the Giant Sainfoin, I beg to inform you that, having obtained some seed, I dibbled it in with the barley-crop in 1847, beside some of the common stock, both under the same treatment.

The continuation of dry weather during the summer materially affected the artificial grasses in this neighbourhood, but the Giant species manifested much more strength and vigour than the common Sainfoin.

This year I seeded both. Neither produced much seed, but the Giant the most, and was much stronger and more bulky in crop, producing afterwards considerably more herbage, which was fed off with lambs; and I particularly noticed the decided preference they gave to the Giant—being turned into the field, they invariably went to that part, and ate it bare before they would go upon the other.

From what I have already witnessed, I am convinced this species is far more productive than the old stock, and only requires to be known to be more extensively cultivated.

The soil upon which my seed was sowed is of a strong loamy nature, with a subsoil of chalk.

I am, Sir, yours, &c.,
To Mr. Hine. George Creed.

Ashwell, Herts.

Sir,—I have had some Giant Sainfoin in plant, more or less, for fifteen or sixteen years, and have always found it produce more in the first crop than the common sort, as well as a crop of seed afterwards.

I have carefully observed it since it has been grown in this parish, and am so convinced of its value, that I should never again sow the common stock for any purpose when this can be obtained at any reasonable rate.

I have used it for soiling for my horses, and find it superior to anything

I have used for that purpose, and am satisfied that those who know its value as well as myself will never farm without it.

I am, Sir, yours, &c.,

To Mr. Hine. JOHN SALE.

Little Marlow, Bucks.

SIR,—In reply to your inquiries, I beg to state I drilled the Giant Sainfoin seed purchased of you with a crop of barley, beside some of the common variety, upon a light chalky soil, and from the commencement there has been a decided superiority in the growth of the Giant over the old stock.

It produced a good crop of hay, and the aftermath was fed off with cows, when I was amused and astonished to see these animals, so soon as from the yard, walk over the old sort to the Giant species, and not take a mouthful till they arrived at the latter.

My opinion, from present experience, is, that the productive properties and superior quality of the Giant species render it fully one-third more profitable than the common sort, though I have for years been aware of the valuable properties of this plant.

I am, Sir, yours, &c.,

To Mr. Hine. JOSEPH WETHERED.

Shepereth Bury, Cambridgeshire.

SIR,—I beg to inform you that I have cultivated the Giant Sainfoin four years, and have sowed it beside the common stock, by planting a piece of the latter between two pieces of the former, when the difference was clearly discernible at a great distance; indeed, it grew from 8 to 10 inches longer in the stalk, and was more rapid and much stronger in its growth. I should certainly not cultivate the common stock again, nor would any of my neighbours, but for the high price at which the seed is now selling.

I am, Sir, yours, &c.,

To Mr. Hine. NASH WOODHAM.

Litlington, Cambridgeshire.

SIR,—In reply to yours, I beg to state I have grown the Giant Sainfoin ten years, and have frequently tested its properties beside the common stock, and, in every case, found it much superior, even upon the weaker chalks, formerly heath-land.

I am so satisfied of its superior qualities, that I would not be without it upon any account.

I am, Sir, yours, &c.,

To Mr. Hine. THOMAS KIMPTON.

Dunton, Beds.

SIR,—I have had a piece of the Giant Sainfoin in plant eight years, beside some of the old stock, planted upon heavy land, well drained; the former has always been much more productive than the latter.

Having grazed horses, cows, and sheep upon the piece, I noticed that each had a decided preference to the Giant species, eating it down bare before they would go to the other.

In every respect, and for every purpose, therefore, I consider it far superior to the old stock.

I am, Sir, yours, &c.,

To Mr. Hine. ROBERT BROWN.

West Halton, Lincolnshire.

Sir,—I beg to inform you that the Giant Sainfoin I purchased of you has succeeded very well.

It is planted upon a light red loamy soil: the seed was dibbled in, and produced this year a good crop, which I mowed for the horses.

It now looks remarkably well, and in my opinion is decidedly superior to the old stock, and will doubtless, after awhile, be generally cultivated

I am, Sir, yours, &c.,

To Mr. Hine. Isaac Green.

Newnham, Herts.

Sir,—The Giant Sainfoin has been cultivated by me, upon a small scale, from a short period after it had obtained so much notoriety.

I have invariably taken a crop of hay previous to a seed-crop, and have obtained, in some instances, as much as 80*s*. per bushel for my seed.

I have planted this species of Sainfoin upon chalk-loam, and also upon heavy land, well drained, but give a decided preference to the latter, where it has always grown the best and strongest.

I have one piece now in plant, upon a clay-loam with a subsoil of clay, which is very thrifty—this was drilled with a wheat-crop after beans,—and another piece, partly upon clay-loam and partly upon chalk; but that growing upon the former description of soil is decidedly the most thrifty.

I am, Sir, yours, &c.,

To Mr. Hine. William Dogget.

Litlington, Cambridgeshire.

Sir,—I have proved the qualities of the Giant Sainfoin to be very superior to the common stock, it having produced a crop of hay and a crop of seed each year it has been in plant.

The first piece I sowed was in 1840, which remained in plant till 1847, when I ploughed it up and sowed the land with oats.

The first crop of hay, independent of the seed-crop, is more than equal to what the old stock would have produced.

I am, Sir, yours, &c.,

Mr. Hine. Thomas Russell.

Launceston, Dorset.

Sir,—In reply to your inquiries respecting the result of my experiment with the Giant Sainfoin I purchased of you, I beg to state that I sowed a field of high, thin, chalk land with Sainfoin, in a barley-crop, planting the Giant species in the middle of the field, to give it a fair trial beside the common variety.

During the ensuing winter it appeared more strong and healthy than the old stock, and at the time of mowing for hay would have produced a much greater quantity per acre; but I allowed it to stand for seed, which was cut on the 13th July, yielding about 16 bushels per acre.

The field was then laid up till October, when the Giant was too bulky for sheep-feed, producing in weight full three times as much as the common sort, or about 25 cwt. per acre, which I used as soiling for my oxen and colts.

As an alternate crop, where broad clover fails, I consider it one of the most profitable crops that can be grown upon high chalky soils, with which the county of Dorset abounds.

I am, Sir, yours, &c.,

Mr. Hine. James Burgess.

Stotfold, Beds.

Sir,—I have cultivated the Giant Sainfoin more with a view to test its real properties than for any other purpose, and have sowed it upon the richest and poorest description of soil I occupy.

The former is a rich, deep, black gravel-loam, where it remained in plant four years, being mowed for hay and seed each year. The plant was thin, but the hay-crop most abundant.

The latter was some land where gravel-stone had been dug and the surface-soil buried, leaving nothing but the siftings to work upon. Here, also, it has answered well, producing both hay and seed the last two seasons; and it has been remarked by myself and neighbours, that the hay-crop alone in each year was superior to the average of the corn-crops I had heretofore grown upon the land.

I now regret that I did not cultivate the plant more extensively at an earlier period, as no one, in my opinion, who knows its value, will cultivate the common variety when this can be reasonably obtained.

I am, Sir, yours, &c.,
Bryan Gibbins.

Bassingbourne, Cambridgeshire.

Dear Sir,—I take the earliest opportunity of replying to your note. I have grown the Giant Sainfoin for some years, and on different soils, but chiefly on thin chalk hills, which I think peculiarly suited for it. I have sown it side by side with the common Sainfoin, and the difference in the growth and produce of the two sorts was astonishing. The Giant comes earlier to maturity, and, I believe, upon all poor, thin-stapled chalk-soils it will supersede the former—growing much earlier, stronger, and of greater produce per acre. You are quite at liberty to make what use you please of the above remarks.

I am, dear Sir, yours truly,
James Lilley.

Littlebury, near Saffron Walden, Essex,
Dec. 26*th*, 1848.

Sir,—In answer to your inquiries, I beg to inform you that I have grown the Giant Sainfoin four years upon a thin rubbly chalk, and have found it considerably more productive than the old sort. Some persons have doubted the distinction, but even the most sceptical have only to see the two varieties growing together to be convinced of the superiority of the Giant. Not only does it mature somewhat earlier for mowing (at the same time producing 20 per cent. more), but the rapidity with which it grows the second, and even the third time, is quite wonderful.

I think, in a few years, when its properties become more generally known, it will be considered by the flock-masters, upon light soils, to be quite indispensable; for, with a moderate breadth of it in plant, they will never know in the summer months what it is to be short of keeping; indeed, I quite expect, at some future time, it will altogether supersede Lucern, for, with the same attention and manuring, I feel confident as much weight may be produced, and, I think, superior in quality, as all growers of Lucern are aware that the second and third cuttings are not relished so much by their stock as the first; but this is not the case with the Giant Sainfoin, which is eaten with avidity at every cutting.

I am, Sir, yours, &c.,
To Mr. Hine. John Clayden.

IV.—*Observations on the Natural History and Economy of various Insects affecting the Potato-crops, including Plant-lice, Plant-bugs, Frog-flies, Caterpillars, Crane-flies, Wireworms, Millipedes, Mites, Beetles, Flies, &c.*

By JOHN CURTIS, F.L.S., Corresponding Member of the Imperial and Royal Georgofili Society of Florence; of the Academy of Natural Sciences of Philadelphia, &c.

PAPER XV.

THE disease* which has assailed the potatoes for the last four years, frequently rendering the crop worthless, and setting human ingenuity at defiance to discover a remedy, appears to result from atmospheric influence, produced probably by a succession of cold, heat, and unusual humidity, which did not agree with the constitution of this imported esculent. Amongst the numerous causes that have been assigned for the appearance of this alarming and severe visitation, insects have been frequently taxed as the destructive agents, but I am convinced the calamity is not to be attributed to their presence.† It certainly was remarkable that the *Aphides* should have swarmed in countless myriads in 1847, but the malady was not then so bad as it was in the previous and succeeding years, which appeared to me to be the most fatal to the potato-crops,‡ yet, as far as my observations extended, the plant-lice were so scarce during 1846 that it was with difficulty I could find specimens, and I did not see a single *Aphis* upon my potatoes in 1848, notwithstanding the crop was worse than it had ever been before in my neighbourhood, more than half of them being rotten. The appearance of the *Aphides* in such unprecedented swarms may fairly be attributed to the same cause as the potato rot—namely, certain conditions of the atmosphere, for it is generally admitted that the appearance of a species of insects in unusual abundance, may be the effect either of some exciting influence, as electricity, or of a congenial temperature, creating a climate favourable to the increase of the animal, such as heat and moisture. In other instances it no doubt is owing to the absence

---

* *Murrain*, being "a plague in cattle," ought never to have been applied to the potato disease, as it frequently has been.

† M. Guérin holds a similar opinion, as well as Mr. Westwood and different members of the Entomological Society of London. *Vide* Bulletin of the Royal and Central Society of Agriculture in Paris, vol. v. p. 331, and Gardeners' Chron., vol. viii. p. 468.

‡ The very great breadth of potatoes planted in 1848 has given so much larger an amount of produce, that the loss from disease is not felt as it would have been had the usual quantity only been grown; and this is a very important fact to keep in view as regards our future prospects. Indeed, is it worth while, *at present* at least, to sacrifice so many acres of valuable land in growing rotten potatoes?

of animals and parasitic insects in the previous year, whose province it would have been to keep within bounds these troublesome enemies to man.

If, however, the prevailing disease amongst the potatoes cannot be traced to the presence of insects, there is a large number of species which prey upon, and undoubtedly injure to some extent, the most healthy crops, and of these the history will now be given. It will be better to divide them into those which affect the foliage, and others which infest the roots, first in a sound, later in a diseased state.

APHIDES, or Plant-lice.

Many varieties of these insects are found upon the leaves of the potatoes during the spring and summer months, indeed so long as the foliage remains green and succulent. Their first appearance depends upon the mildness of the weather, for when it becomes cold they do not generate, or at any rate very slowly, so that the species disappear; but if a plant be taken and protected in a greenhouse or sitting-room, their economy is not interrupted even in the winter, as one sees by the Pelargoniums being covered with *Aphides* when they are neglected. I have at this time (January) two tulips in a pot, the convoluted leaves swarming with *Aphides*, allied to the one infesting the peach-trees: the apterous females are daily bringing forth young, and the pupæ are hatching and producing winged females.* But to return: I very much doubt if there be any species exclusively attached to the potato, for the one named *Aphis vastator* by Mr. Smee appears to me to be identical with my *A. Rapæ*, which inhabits turnip-leaves, and was described and figured in this Journal in 1842.†

In confirmation of my views I may state that, in April, Mr. F. J. Graham has detected the *Aphis Persicæ* ‡ upon the potato-leaves in his vinery; the beginning of May, Mr. Denham found *A. granarius*, or an allied species, in some abundance on the potato-leaves at Broxmouth Park. On the 5th of June, 1847, I observed upon my potato-haulm the hop-fly (*Aphis Humuli*) and the turnip-plant louse (*A. Rapæ*); on the 13th also a species without honey-tubes; on the 17th several belonging to a group separated from Aphis, and called *Schizoneura*; and in July, *Aphis Fabæ*, the broad-bean louse, was in some force upon the potatoes, whilst it was swarming upon other vegetables and garden flowers; for instance, the shoots of dahlias, the underside of the leaves of the convolvuli, French and scarlet beans, beet, and parsnips were

---

* Mr. F. Walker considers they are the *A. vastator* of Smee.

† Vol. iii. p. 53, pl. C, f. 1, 2, 3, and Gardeners' Chron., vol. vii. p. 21.

‡ Curtis's Guide, Genus 1047, where nearly sixty species are arranged.

literally covered and black with the winged females, sticking in closely-packed phalanxes, and in that position they died by the end of July or earlier—without killing any of the plants, to the best of my knowledge.

No one acquainted with cultivation will attempt to deny that the plant-lice have the power to destroy a crop,—for instance, the horse and broad beans were a light crop, and entirely failed from the attacks of *Aphis Fabæ* in many districts in 1847; but in that very year the potatoes in gardens, where the *Aphides* were abundant, proved sound crops; whilst in 1848, where no *Aphides* could be found, the tubers were worse than at any former period. That *Aphides* will puncture the potato-leaves there can be no doubt, and so incline them to wither; but there is no proof of their poisoning the sap and causing the rot. Indeed it is only when plants are smothered with them, as we see beans, turnips, hops, and roses occasionally are, that their presence causes any real mischief, and then it simply arises from the local exhaustion produced by the abstraction of the sap from the leaves or young shoots, and of course when the circulation is impaired and the cellular tissue is deprived of its nourishment and dried up, the foliage becomes spotted and withers; but in no instance have I seen the *Aphides* on the *potatoes* in sufficient numbers to destroy the crop, or even to injure the produce.

The economy of the *Aphides* has been so amply detailed in a former volume,* that I shall now merely identify the species above noticed.

1. Aphis Rapæ, *Curtis,* Journal of Royal Agric. Soc., vol. iii. p. 53, pl. C, figs. 1, 2, 3.

Having received so many different species from various correspondents with the name of *A. vastator*, it is difficult to decide which is intended for the authentic one; but some which were stated to be typical examples, and identical with those figured and described by Mr. Smee, leave little doubt on my mind that they are the same as the *Aphis Rapæ.*

2. A. Humuli, *Curtis,* Gardeners' Chron. for 1846, p. 405.

The winged specimens are exceedingly like *A. Rapæ* in size and colour.

3. A. Persicæ, *Morren,* is very like the preceding species, but it is rather larger, with much longer and slenderer ducts. In the autumn of 1834 prodigious swarms of this species were carried by a hurricane over many parts of Belgium.†

4. A. Fabæ, *Scop,* Journal of Royal Agric. Soc., vol. vii. p. 418, pl. R, figs. 21 and 22.

---

* Journal of Royal Agric. Soc., vol. iii. p. 49.

† Ann. Acad. Roy. des Sci. de Bruxelles, for Aug. 1836.

To render the history of this species more complete, the female and pupa are represented in our plate U; figs. 1 and 3, magnified; figs. 2 and 4, the natural sizes.

5. Schizoneura lanigera, *Hausen?* belongs to a group which has been separated from the genus *Aphis* in consequence of the different neuration of the wings, &c. The winged specimens are only accidental inhabitants of the potato, and may frequently be observed on almost every plant in the garden. As a proof of the great fecundity of these insects, I put three from the potatoes into a quill, and in 6 hours they had produced 43 young ones.

At the same time the natural enemies of the *Aphides* were not inactive: the lady-birds (*Coccinellæ 7-punctata* and *C. dispar**) were laying their eggs, which soon hatched, and the little black larvæ made great havoc, as well as their parents, amongst the helpless communities: the beautiful 2-winged flies (*Scæva balteata*† and *Cheilosia tæniata* ‡) were also depositing their eggs beneath the potato-leaves, where they soon hatched, and the maggots commenced feeding on their Aphis prey. These eggs are white, oval, and beautifully granulated, whilst those of the lady-birds are smooth, and of an orange or buff colour.

There are likewise some minute bugs and their larvæ, which are exceedingly serviceable in destroying the *Aphides;* and there seems to be scarcely a plant or tree where they may not be found; the perfect insects inhabiting the flowers, and the immature ones running about in search of the *Aphides,* which they transfix with their sharp rostrum.

These bugs are included in the ORDER HEMIPTERA, the FAMILY COREIDÆ, and the GENUS HYLOPHILA or ANTHOCORIS. The 1st species is called

6. H. Nemorum, *Linn.*: it is only 1½ line long: fig. 5; 6, the natural size. It is black and shining, the head is trigonate, narrowed before, with a 3-jointed rostrum bent under the breast; the 2 globose eyes are prominent, and the 2 minute ocelli at the base of the crown are remote: the 2 horns are half as long as the body, straight, 4-jointed and black; 1st joint short, 2nd the longest, bright ochreous, the tip black; 3rd and 4th of equal length, the former ochreous at the base, the latter conical at the apex: thorax triangular, truncated before with two transverse channels: scutel triangular, acute, and not small: elytra elliptical, lying flat on the back, and extending beyond the abdomen, pale ochreous, with a spot at the suture, a bar or spot on the disc of each, and the oblique margin all fuscous; the terminal membrane is white, with a fuscous spot on the disc and a larger one at the

---

* Jour. of Royal Agric. Soc., vol. iii. p. 57, pl. C, figs. 15 and 16.

† Ibid., vol. iii. p. 66.

‡ Curtis's Guide, Genus 1241, No. 3.

tip: beneath are 2 transparent but iridescent wings, with a smoky spot at their tips: the 6 legs are bright ochreous and slender, the base and tips of the shanks, as well as the feet, are pitchy, and there is a ring of the same colour near the apex of the hinder thighs. It varies so much in the markings, that the different varieties have been described under the following five names by Fabricius, viz., *sylvestris, fasciatus, nemoralis, austriacus*, and *pratensis.*

They hide themselves when disturbed, often running into chinks in the bark of fruit and other trees, where probably the eggs are deposited; likewise under loose bark as well as in moss, where they hybernate, to come forth again in the spring.

The larva (fig. 7; 8, the natural size) is very minute at first, yet it resembles the parent in having a rostrum, horns, and 6 legs, but it is narrower, of a blood or chestnut colour, more ochreous when fasting, and it has no wings: the head is furnished with a very acute rostrum, longer than the head, the horns and legs are ochreous, the terminal joint of the former being the stoutest and of a blood colour. Fig. 9, the thorax and head nearly in profile. The pupa (fig. 10; 11, the natural size) is as long and broader than the perfect insect, which it greatly resembles in form, and it is equally active and useful: it is of a deep shining chestnut colour; it has no little eyes on the head: on each side of the back lies a flat rounded lobe, ochreous at the tip, and they contain the incipient elytra and wings: the body is broad, convex and orbicular: the horns and legs are ochreous, the first and last joints of the former of a chestnut colour.

7. H. minuta, *Linn.*, is a smaller species, being little more than 1 line long: fig. 12; 13, the natural size. It is shining black: the horns are brown, ochreous at the base: hinder part of the thorax punctured: elytra ochreous and punctured, the apex fuscous; membrane smoky on the disc: beneath them are 2 transparent wings: legs ochreous, tips of feet dusky. The larva and pupa are smaller than those of the former species, but they are equally beneficial, I believe, in preying upon the *Aphides.*

FLIES, or MUSCIDÆ.

Mr. E. Doubleday transmitted to me some flies which were stated to be laying their eggs in the young shoots of the potatoes, and causing the rot. They belong to the ORDER DIPTERA, the FAMILY MUSCIDÆ, and the GENUS SAPROMYZA. The species has been named by Fallen

8. S. obsoleta.* It is bright ochreous, producing a few long black bristles: the eyes have 2 purple lines when alive, but are

---

* Curtis's Brit. Ent., fol. 605, and Guide, Genus 1295.

brown when dead: the apical half of the 3rd joint of the horn is black as well as the pubescent seta: the abdomen is rather small: wings ample, yellowish and iridescent, but transparent, nervures ochreous: balancers with a large triangular club: legs whitish-ochre; at the apex of the hinder shanks, where the spur is inserted, is a brown spot; the feet are dusky, the hinder thickened, especially the basal joint: expanse of wings 5¼ lines.

The larvæ of most of the *Sapromyzidæ* are said to live in putrid substances, as mushrooms, &c., but Mr. Haliday has bred *S. rorida* from flowers.

THRIPS.

In the summer of 1846 Mr. Barnes of Bicton* and many other practical gardeners entertained so strong a conviction that a little *Thrips* was the author of the potato epidemic, that I carefully investigated the subject, and was soon satisfied the disease could not be attributed to their agency. On the 30th of July Mr. Barnes sent some diseased potato-leaves with several of the little *Thrips* upon them. Being in Oxfordshire at the time, I immediately visited several allotments where I had observed the leaves and stalks were spotted. On digging up some of the worst, we found a *diseased* tuber of good size, and two more the following day. After a diligent search I detected the larva and pupa of the *Thrips*, as well as the perfect insects, amounting to about twenty specimens. The *Thrips* was most abundant where the plants were sheltered from the wind, invariably inhabiting perfectly healthy leaves; and on the following morning I could find very few. In another spot, where the leaves were dead and the haulm spotted, we did not find one bad potato amongst those we dug up, nor a single *Thrips* on the green leaves of a few healthy-looking plants still remaining.

Various species of *Thrips* injure different crops of grain and fruit, as well as greenhouse plants, by abstracting the fluids which ought to sustain them, and so far the Potato-Thrips acts upon the leaves, but that has nothing to do with the rot in the tubers. When they congregate in countless myriads, as they often do in melon and cucumber frames, their presence is soon indicated by ochreous spots upon the cuticle, which end in the destruction of the leaf, arising from their puncturing it with their short beaks, and extracting the sap in the same manner as the *Aphides;*† but their number upon the potatoes was never sufficient to effect any important change on the constitution of the plants.

These minute creatures run with activity over the surface of

---

* Gardeners' Chron., vol. vi. p. 532.

† Journal of Royal Agric. Soc., vol. vi. p. 500, *Thrips cerealium.*

the substances they feed upon, and no doubt the winged individuals can fly. The larva is shuttle-shaped and ochreous; the head is small and oval, with a minute black eye on each side, and a short beak beneath; the 2 horns are twice as long as the head, slightly pubescent and 4-jointed; first 2 joints small, 3rd egg-shaped, 4th nearly as long as the others united, ovate at the base and attenuated to the apex: trunk very long and broad, composed of 3 segments, the 1st trigonate with rounded angles, the 2 following forming broad bands; the abdomen is as wide as the thorax, composed of 9 segments, conical and hairy at the apex: 6 short legs; thighs very short; shanks dilated; feet indistinct or wanting (fig. 14; 15, the natural size).

The pupæ are also ochreous, but before they change to the perfect state they become much darker; and being such atoms they are not easily detected under the leaves when at rest, lying close to the midrib or nervures, but they run about lively enough when disturbed.

They belong to the ORDER HEMIPTERA,* the FAMILY THRIPSIDÆ, and the GENUS THRIPS, The species on the potato was described by Linnæus a century back, under the name of

9. T. minutissima (fig. 16; 17, natural size). It is scarcely $\frac{1}{3}$ of a line long; pale brown or dirty ochreous: the horns are short and 6-jointed; the eyes are intensely black: the trunk is concave, and the sides parallel: the abdomen is oval, pointed, piceous, and shining: the 4 wings, lying parallel on the back, are narrow, dirty white, and ciliated: 6 short legs, stoutish and ochreous; shanks and feet simple.

SMYNTHURUS and PODURA; the Ground-fleas.

In July and August numbers of these curious little creatures accompanied the Thrips, running and skipping about the underside of the potato-leaves, often falling down upon their backs.

They constitute an ORDER called THYSANURA, and belong to the GENUS SMYNTHURUS. As I cannot find any description which entirely agrees with the potato species, I have named it

10. S. Solani. It is not bigger than a small grain of sand, and either entirely of a deep ochreous colour with black eyes, or as black as soot with ochreous horns: the head is large, like a great mask, and attached by a slender neck: the eyes are placed on each side of the crown; the horns are more than half the length of the body, slender, elbowed, and 4-jointed? the trunk and body are united, forming a large globose mass, with a forked tail doubled under the latter for leaping: the 6 legs are rather

---

* Mr. Haliday raised the Thrips to a distinct order, *Thysanoptera;* Ent. Mag., vol. iii. p. 439, and Curtis's Brit. Ent., fol. and pl. 748.

short, and apparently triarticulate (fig. 18, magnified; 19 is to show the leaping apparatus in another species).

These minute animals are nourished by eating the parenchyma of the green leaves, but some species feed on fungi. In Nova Scotia the crops of turnips and cabbages are principally destroyed, whilst in the seed-leaf, by some *Smynthurus*, the size of a pin's head, and nearly globular. It hops with great agility by means of its forked tail, and may be found on every square inch of all old cultivated ground, but it is not plentiful on new land. As these "Ground-fleas" will not remain on damp ground, they may be expelled by sprinkling salt over the land after the seed is sown and well rolled down, or a thin layer of sea-weed spread over the drills is a perfect security against them.*

An allied Genus called *Podura* has very lately been accused of being the origin of the potato-disease. W. P. says—

"First, in an early stage of its existence, it lives on decayed vegetable matter, which it collects by burrowing into the earth; secondly, it occurs in numbers sufficient to cover nearly the whole surface of the earth; thirdly, it collects, as a means of existence, a substance which is poisonous to vegetables. It has power to infuse this into living plants by burrowing into the parenchyma. The poison is circulated through the system, vital action becomes suspended, mildew immediately follows, and in less than three days some of the plants attacked are dead vegetable matter, food for the offspring of the newly-discovered *Podura*."†

Dr. Lindley very justly adds, "Insects are not the cause of the potato-disease."

CIMICIDÆ, or Plant-bugs.

It is somewhat remarkable that whilst portions of these creatures, as we have already shown, are destined to live upon *Aphides*, and so preserve our vegetables, others have an opposite taste, and, like the Plant-lice, pierce the cuticle to feed upon the juices, causing similar injury by parching up the leaves, or covering them with blotches.

The appearance of various species of Plant-bugs, their larvæ and pupæ, upon the potato-crops, excited the attention of agriculturists, some of whom were at once disposed to attribute the prevalent disease to these insects. The truth is, when an unknown malady first visits us, it is natural that every one interested should endeavour to find out the origin, consequently every imaginary influence is taxed as the cause by the speculative mind; and from the little attention that is paid by the farmer and gardener to the economy of insects, they are led to believe that certain tribes of animals are the culprits, because they chance to be

---

* Halifax Times.

† Gardeners' Chron. vol. viii. p. 702.

abundant upon the plants, and they never observed them before; but if their attention had been directed to the subject earlier, they would in all probability have detected the same insects upon the same plants every year, in greater or less abundance.

In July and August, 1846, I had numbers of specimens transmitted to me from Devon, Winchester, and various counties, the parties expressing a strong conviction that these Potato-bugs were the cause of the disease. The cry was raised again in 1847, in the same months, which led to the subject being noticed in the Gardeners' Chronicle.*

That these insects live upon the foliage of the potatoes there can be no question, and therefore it will be advisable to identify the species so that at any future period no unnecessary apprehensions may be entertained should they appear in unusual numbers.

They all belong to the ORDER HEMIPTERA, the FAMILY CORISIDÆ, and the GENUS LYGUS or PHYTOCORIS. One species appearing different from any described, I have named it

11. L. Solani (fig. 20; *c*, the natural length). It is green, shining, punctured, and clothed with soft depressed pale hairs: head small, smooth, transverse-oval, and ochreous; face triangular, with a long 4-jointed rostrum bent under the breast in repose: the eyes are small, prominent, lateral, oval, and black; the two horns are ochreous, brown beyond the middle, long, very slender, angulated, and 4-jointed, basal joint the stoutest, longer than the head, 2nd twice as long, 3rd longer, 4th shorter than the first. Thorax ochreous, convex, triangular, truncated before, twice as broad as the head at the base; scutel triangular: abdomen entirely green; the female with a channel beneath, enclosing the horny oviduct: elytra very long, elliptical, as broad as the thorax, resting horizontally on the back; stigma green, like the elytra; membrane transparent, iridescent, the nervures bright green: wings ample, transparent: 6 long slender ochreous legs, hinder very long; feet ochreous, all pitchy at their tips, and terminated by 2 claws; hinder thighs the stoutest, the shanks very long, slender and spiny: length nearly 3 lines. It is possible this species may be a variety only of the *Cimex pabulinus* of Linnæus, or the *Phytocoris prasinus* of Fallen.†

As soon as these insects leave the egg they can run about, being furnished with legs, horns, and a rostrum like the parents, but they are deprived of the organs of flight. As they grow they attain 2 lobes on the back, which enclose the future elytra and wings, and then they are called Pupæ (fig. 21; *d*, the natural length). In every stage of their existence they feed in the same

---

* Vol. vii. p. 468.

† Curtis's Guide, Genera 1100 and 1103.

manner; but the perfect insects, which emerge from the matured pupæ, can fly well, are exceedingly active, leaping by short flights and tumbling about in the sunshine, so that it is difficult to capture these fragile creatures, especially without mutilating them. They were abundant from the middle to the end of August in 1846 and 1847.

12. L. contaminatus, *Fallen*, is very similar in size and form to the foregoing species (fig. 22; 23, natural size; fig. 24, the head, &c., in profile). It is ochreous, the base of the thorax and the elytra inclining more or less to green, and the membrane is margined with a smoky colour; but it varies considerably, some having a dark spot at the base of the stigma, forming a bar across when the elytra are closed; the suture is also brown, as well as the nervures of the wings, and a patch on the back of the abdomen. It is 3 lines long: the wings expand 5½.

This species was abundant on my potato-crop in August, 1846, and it abounds on lime-trees from the beginning of May to the middle of August, or later.

13. L. bipunctatus, *Fallen* (fig. 25; 26, natural size), is a more robust insect. It is green, more or less ochreous when dead: the horns are stoutish, ferruginous, dusky at their extremity, with a pitchy spot beneath the first joint towards the base; the rostrum, in repose, extends to the hinder coxæ, and is pitchy at the tip. In some varieties there are 2 black dots on the disc of the trunk, and it is ochreous before: back of abdomen shining black, with the lateral margins pale: elytra with depressed black hairs, and generally with indistinct stripes or splashes of brick-red; membrane smoky: wings ample, smoky, with darker nervures: legs stoutish, especially the hinder; thighs ochreous, rusty at their extremities, tips of tibiæ and feet pitchy. Length 3¾ lines, expanse 7 lines.

This species was very abundant the end of August, 1846, upon the potato-haulm,* as observed by Mr. Balkwill and other gardeners. In summer it is often found on nettles in Ireland and England.

14. L. umbellatarum, *Panzer* (fig. 27; *g*, the natural dimensions), is a more oval species, with slenderer horns and legs: it is pale green or ochreous, shining, punctured, and pubescent: head smooth, inclining to red; horns rosy, tip of 2nd joint with the two following brown: thorax rosy behind, and coarsely punctured, smooth before, with a transverse waved channel: scutel white, black at the base, sometimes with 2 longitudinal black or rosy lines next the thorax: body shining black above, margined with ochre: elytra elongate oval, clouded with red, the costa deeply

---

* Gardeners' Chron., vol. vi. p. 557.

notched at the base of the stigma, which is tipped with brown, the oblique and oval nervure scarlet; membrane with a smoky border and a dot within the cell; wings ample, iridescent, nervures dusky: legs ochreous, slender, and rather short, excepting the hinder pair; thighs with a reddish or brown ring near the apex, 2 rings in the hinder, the shanks spiny, all tipped with brown; feet pitchy. Length 2¾ lines, expanse 6 lines. This pretty species varies much, and some examples are very rosy.

At the commencement of September, 1846, it was abundant on diseased potato-haulm in many localities. It inhabits grasses in May, and later in the year it is found upon the flowers of umbellatæ. It is spread far and wide, for I have caught numbers in Scotland, especially in the isles of Skye and Arran.

Two other species, *Phytocoris pabulinus* of Linnæus, and *P. viridulus*, Hahn, are recorded as inhabiting and injuring the potato crops.* It is evident, by the following extract from a letter of a resident in South Australia, communicated to Mr. Thwaites, that the potato disease in that remote country, in 1847, has been ascribed to some insect allied to those infesting our own crops. The writer says—" The fly which destroyed the potato crop was a small white *Tree-bug*, with transparent wings, not half the size of the common house-fly. They ate up all the tops of the potatoes, so that there was not a leaf to be seen, and of course the roots were useless where they attacked them in the early state." †

The following accurate observations of Dr. Harris will show that similar injuries were inflicted upon the potatoes in the United States ten years back, and that insects had been suspected of assisting in the destruction of the crops. He states that it was a species of Plant-bug closely allied to *Phytocoris campestris* of Linnæus, and described as the *P. lineolaris* of Palisot de Beauvois, and the *Capsus oblineatus* of Say.

" During the summer of 1838," says Dr. Harris, " and particularly in the early part of the season, which it will be recollected was very dry, our gardens and fields swarmed with immense numbers of little bugs, that attacked almost all kinds of herbaceous plants. My attention was first drawn to them in consequence of the injury sustained by a few dahlias, marigolds, asters, and balsams, with which I had stocked a little border around my house. In the garden of my friends the Messrs. Hovey, at Cambridgeport, I observed about the same time that these insects were committing sad havoc, and was informed that various means had been tried to destroy or expel them without effect. On visiting my potato-patch shortly afterwards, I found the insects there also in great numbers on the vines; and from information worthy of

---

* Gardeners' Chron., vol. vii. p. 468.
† Trans. Ent. Soc., vol. v. p. xxxiii.

credit am inclined to believe that these insects contributed, quite as much as the dry weather of that season, to diminish the produce of the potato-fields in this vicinity. They principally attacked the buds, terminal shoots, and most succulent growing parts of these and other herbaceous plants, puncturing them with their beaks, drawing off the sap, and, from the effects subsequently visible, apparently poisoning the parts attacked. These shortly after withered, turned black, and in a few days dried up or curled, and remained permanently stunted in their growth. Early in the morning the bugs would be found buried among the little expanding leaves of the growing extremities of the plants, at which time it was not very difficult to catch them; but after they had become warmed a little by the sun they became exceedingly active, and on the approach of the fingers would loose their hold and either drop suddenly or fly away. Sometimes, too, when on the stem of a plant, they would dodge round to the other side, and thus elude our grasp.

"I have taken this insect in the spring as early as the 20th of April, and in the autumn as late as the middle of October; from which I infer that it passes the winter in the perfect state in some place of security. It is most abundant during the months of June and July. It seems to be very generally diffused through the Union."*

Dr. Harris attributes the great increase of noxious insects to the exterminating war which has been wantonly waged upon the insect-eating birds. A hint, to place a hen-turkey or duck under a crate or cage, and let the young ones scour the garden, is worth attending to.

POTATO FROG-FLIES.

Equally or more abundant than the Plant-bugs were these suctorial insects, which were hopping and flying over the potato grounds from the end of August until the crops were lifted the end of September. Every one has observed upon holyhocks and other flowers little patches of frothy matter called "Cuckoo spittle:" they are occasioned by a tender little animal, which by sucking the plant buries itself in this froth, which protects it from heat and other inimical effects, until it is full grown, when it changes to a pupa, and from this emerges the perfect insect, called by Linnæus *Cicada spumaria.*† The Potato frog-flies are of the same family, only the larvæ do not secrete froth, but move about like their parents.

There are two species inhabiting the potato-haulm: they belong to the ORDER HOMOPTERA, the FAMILY TETTIGONIDÆ, and the GENUS EUPTERYX.‡ One is closely allied to Fabricius's *T. flavescens,* which is larger, and, as I am doubtful of their being identical, I have named the Potato species

---

* Harris's Treatise on Insects, pp. 162, 163.

† *Tettigonia spumaria,* Curtis's Guide, Genus 1060, No. 6, and Gardeners' Chron., vol. ii. p. 509.

‡ Curtis's Brit. Ent., fol. and plate 640.

15. E. Solani * (fig. 28, flying; *h*, natural dimensions). It is of a lively green colour, but fades after death to a yellowish green: the head is broad, short, and crescent-shaped above, with 2 lateral prominent brown eyes: fig. 29, head, &c., in profile: the face is beneath, somewhat oval and very long, the apex producing a rostrum, and in a cavity on each side, before the eyes, are inserted the antennæ, which are short, and like 2 fine bristles, arising from 2 minute subglobose joints: the trunk is smooth, transverse, and semi-orbicular; the scutel is triangular, acuminated at the apex: the abdomen tapers to the apex, and is conical in the female, with a long and stout ovipositor beneath, formed of 2 sheaths, ciliated with hairs and enclosing the oviduct: wings 4, lying over the back in a convex form, when at rest; the superior, called elytra, are twice as long as the body, narrow and elliptical, the nervures scarcely visible; they are very glossy and iridescent, the extremity rusty; inferior wings ample, nearly as long as the elytra, beneath which they are folded, being exceedingly delicate and iridescent: the 6 legs are very slender, the first pair are short, the hinder very long; thighs short and slender; the anterior shanks are armed with spines on the inside only and not to the apex; the hinder are long with a double row of spiny bristles on the outside; feet moderately long and tri-articulate, basal joint the shortest, 2nd the longest, but in the hinder pair the basal joint is the longest; claws and pulvilli minute. Length 1 line, expanse 2¾.

The females have been observed by Mr. F. J. Graham, depositing their eggs under the potato-leaves: these are white, cylindrical and somewhat shuttle-shaped, more pointed at one end than at the other, and striated with numerous furrows forming ridges: fig. 30; *l*, natural size: the little creatures which hatch from them are green with 2 horns and 6 legs, as well as a rostrum to pierce the cuticle of the plant. The pupa (fig. 31) is green, and nearly as large as the parents, but narrower: the body tapers considerably: the head is broad and the 2 black bristles forming the horns are much longer than in the perfect insect: it has 2 large black eyes: the stout rostrum lies under the breast, extending to the hinder hips; it is flexible and 3-jointed, enclosing the 4 mandibles and maxillæ, which protrude beyond the apex like the finest bristles: the lateral lobes enclosing the future wings look like the pinions of a bird: it has 6 legs, the hinder pair being the longest. When these pupæ are full grown they attach their feet to the stalk or leaf, and by bursting the horny skin on the back, the perfect insect crawls out and is thus liberated. These skins, as well as those cast off by the larvæ during their

---

* Gardeners' Chron., vol. vi. p. 388.

growth, are sometimes seen in multitudes adhering to the foliage or lying on the ground beneath.

The perfect potato frog-fly is often abundant from the middle of August to the end of September, when not unfrequently a dozen may be seen on one leaf. In dull weather they have a curious mode of evading notice by sidling round to the opposite side of the stem or beneath a leaf, but in bright warm days they leap and fly short distances.

The other species, which is equally abundant, has been named by Fabricius

16. E. picta: fig. 32; *m*, the natural dimensions. It is very similar in form to *E. Solani*, but it is larger and beautifully spotted: it is of a clear yellow colour, with 2 oval black spots on the crown of the head, and one on each side of the face, 2 larger ones on the trunk with 2 dots before, and 2 black spots at the base of the scutel: the abdomen is black, the margins of the segments yellow, the superior wings are clouded with brown, leaving the base, the tip, 2 large spots on the costa, and 2 on the suture, yellow, with smaller pale spots on the disc; inferior wings iridescent and transparent, the nervures brown: legs entirely of a sulphur colour. Length 1½ line, expanse 3 lines.

The pupa of this species is of an uniform buff colour: the eyes and tips of the feet alone being dark.

On the 19th of June, 1847, I first observed this species upon my potatoes, and in August they had increased greatly in numbers, the foliage being still green and healthy: they flew about a foot when disturbed, but did not leave the plants, alighting directly upon the leaves and sidling under them when alarmed. The pupæ were equally numerous under the leaves, with the exuviæ by them. This frog-fly also inhabits nettles, the burdock, and mint, and I have found it as late as November in gardens.

ALTICA.

In company with the foregoing insects was one of the *Alticæ*, or leaping *Chrysomelæ*. They first appeared about the middle of June, and they continued feeding until the leaves withered. During the whole of August, 1846, they were in multitudes on the Bitter-sweet (*Solanum Dulcamara* *), a plant belonging to the same genus as the potato; the leaves of which they completely riddled. They are also abundant on grass till late in the autumn, but nothing is known of the larvæ or where the eggs are deposited.

This beetle is comprised in the same group as the turnip-flies (*Altica Nemorum* †), but owing to the different form of the horns

---

* Curtis's Brit. Ent., pl. 102.

† Journal of Royal Agric. Soc., vol. ii. pp. 195 and 211.

and feet, it has been separated from them. It belongs to the ORDER COLEOPTERA, the FAMILY CHRYSOMELIDÆ, the GENUS MACROCNEMA,* and appears to be the Linnæan species †

17. M. exoleta: fig. 33; 34, the natural size. It is oval, convex, shining and ochreous: the head is black, with prominent eyes, 2 long clavate 10-jointed horns, 2 basal joints elongated, 3rd a little shorter, the extremity dusky: thorax punctured, deep ochreous, transverse, slightly narrowed before, sides rounded; scutel minute: elytra pale ochreous, the suture pitchy; there are 8 faintly-punctured striæ on each, and a short one on either side of the scutel; wings ample: underside pitchy: legs dark ochre; hinder thighs very thick and pitchy; the shanks rather short, the internal angle forming a curved lobe at the apex, which is cut off obliquely; feet 4-jointed, 3rd joint bilobed; hinder very long and inserted on the inside of the shank, basal joint as long as the others united: the apex furnished with 2 claws. Length 1 line.

SPHINX ATROPOS, the Death's-head, or Bee Tiger-moth.

Potato-leaves do not seem very palatable to caterpillars, for with the exception of two green-striped ones and those of the Death's-head Sphinx, I do not know of any which feed upon them. The noble larva of this moth is occasionally abundant in potato-grounds, sufficiently so lately to induce the peasants in Kent to collect and give them to their poultry, yet twenty years back they were far from common, since *British* specimens of the moth were so much sought after by naturalists, that half-a-guinea was willingly paid for a fine native example. The unusual abundance both of the caterpillars and moths in 1846, was owing, it is presumed, to the high temperature in June and September, and it is not a little surprising that they should have escaped being included in the Calendar with the other insects accused of destroying the potato-crops; more especially as the moth bears a very bad character: even its name of "*Atropos*" is intended to imply its awful errand, as well as the familiar ones of Death's-head, Tête de Mort, and Todtenkopf, which it bears in this country, in France and Germany, appellations derived from the image impressed upon its back; so that when *Atropos* intrudes itself into a dwelling amongst the rural inhabitants of the Continent, it causes no little consternation, since it is considered the messenger of pestilence and famine, if not of death. It is undoubtedly to be dreaded by bees, for it has the audacity to enter their hives and lap up the honey. It is from this propensity it has received the English name of "Bee tiger-moth," and it is

---

* Curtis's Brit. Ent., fol. and pl. 486.

† Fauna Suecica, No. 541, and Curtis's Guide, Genus 428, No. 10.

supposed to gain admission by imitating the note of the Queen bee,* and being so thickly clothed with velvet over a horny case, it may laugh to scorn the stings of the bees.

This handsome moth is certainly a remarkable creature—it is so conspicuous from its size that no one can overlook it; for it is as big as a bat, the human skull depicted on its back is often very perfect, and it can utter a cry something like the faint squeak of a mouse, but more plaintive. The caterpillar rests like the classic Sphinx of Egypt, hence that distinction has been assigned to it, and it is very remarkable that an Egyptian mummy bears a great resemblance to the brown horny chrysalis.

It is not yet ascertained where the female moth lays her eggs: they must be as large as mustard-seeds and cannot be deposited upon the foliage of the potatoes by the autumn brood; indeed it has been ascertained that the females are then sterile. It is therefore quite possible that the eggs are generally laid by the earlier brood upon or under the potato-leaves.

The caterpillars seem to have fed principally upon the leaves of the jasmine formerly, but I am not aware that they are found now upon any other plants in England than the potato, although they will live upon the bitter-sweet, tomato, thorn-apple, spindle-tree, elder, damason, and hemp. They come out to feed at night, and grow until they are nearly as long and as thick as a lad's middle finger, when they are of a yellow or greenish tint with 7 oblique bands on each side forming acute angles on the back; these stripes are blue, lilac, and white: the head is horny and furnished with strong jaws; it has 6 pectoral feet like claws, 8 fleshy abdominal feet and 2 similar anal ones, above which is a rough curled tail, and on each side are 9 breathing pores called spiracles. When full grown the caterpillar buries itself in the earth, where, with a fluid from its mouth and by the action of its head and body, it forms a smooth oval cell: having rested from this labour, it draws off its skin and then is wonderfully transformed into a chrysalis or pupa enclosed in a horny shell of a chestnut colour; the head blunt, the tail pointed, the eyes, proboscis, and wings being defined, and the body composed of several rings with breathing pores on each side, and if touched or breathed upon it wriggles its body to and fro. The first brood of caterpillars is thus transformed in July, and these produce moths in September and October, whilst those that arrive at perfection in the autumn do not hatch until the following spring. They were equally abundant in France in 1846 and there they remained in pupæ only 3 or 4 weeks.

The moth belongs to the ORDER LEPIDOPTERA, the FAMILY

---

* Reaumur, Hist. Nat. des Insectes, vol. ii. p. 289.

SPHINGIDÆ, and was included in the GENUS SPHINX, until it was separated from that immense Family and received the appellation of ACHERONTIA. The species was named by Linnæus

18. A. Atropos.* The wings sometimes expand 5 or 6 inches: it is densely clothed with short pile, like fustian: the eyes are large and prominent, and close to them at the back part of the head are inserted the horns, which are stoutest in the males, rather short, robust, and black, narrowed at the base, white and hooked at the tips: in front of the head are 2 erect palpi, and between them a short, stout, horny, black proboscis, which is rolled up spirally in repose: the thorax, as well as the head and superior wings, are black, with an ashy tint; on the former is an orange-coloured figure resembling a human skull, with the neck and collar-bones: the abdomen is black with a greyish stripe down the back and 5 or 6 long orange spots on each side, alternating with as many black bands: wings sloping (like the roof of a house) in repose: superior black minutely freckled with white, variegated with rusty patches, and several black transverse broken waved lines; one near the base, 2 others nearer the apex and a spot on the disc, bright ochreous: inferior wings bright orange with 2 black indented bars nearly parallel with the margin, which is formed of orange spots; the fringe of the wings is scarcely visible: it has 6 stout black legs, with 2 strong and distinct claws on each foot.

Although the Death's-head caterpillars either retire into the ground by day or otherwise secrete themselves, coming forth principally at night to feed, they are not secure against the untiring diligence of an Ichneumon fly, which lays her eggs in the body of the larvæ, where the maggot hatches, grows to a large size, and changes to a pupa within its victim, from which eventually the parasite emerges instead of the moth.

It is the largest of our British *Ichneumons*, and is included in the ORDER HYMENOPTERA, the FAMILY ICHNEUMONIDÆ, and the GENUS TROGUS.† The species I named, after the insect it was bred from,

19. T. Atropos.‡ It is bright ochreous: head transverse with a black stripe on the crown, spreading along the base and terminating in a point on the face; eyes lateral, with 3 ocelli in triangle on the crown; antennæ black, the basal portion orange, long and setaceous, inserted close together near the middle of the face, composed of about 40 joints, 1st joint the stoutest: thorax robust, oval, and black; scapulars, a line before them and a spot beneath,

---

* Curtis's Brit. Ent., fol. and pl., 147, where coloured figures of the moth and caterpillar are given, as well as dissections.

† Curtis's Guide, Genus 496.

‡ Curtis's Brit. Ent., fol. and pl. 234.

ochreous; scutel conical and yellow; postscutel rough with a shining knob at the base and 2 elevated lines down the middle, forked at their extremities: abdomen long, elliptical, clavate, attached to the thorax by a clubbed petiole; slender at the base, sometimes with a black line beneath, 7-jointed, the 4 last segments black: wings ample, shining golden yellow, the hinder margins smoky, superior with a pentagonal areolet; stigma and nervures ferruginous: legs stout, 1st pair the smallest, hinder the largest; coxæ black; hinder thighs the thickest, black at the apex, especially beneath; anterior shanks short, hinder long, brown at the tips; feet longer than the shanks, 5-jointed, terminated by 2 strong claws tipped with black, and dusky pulvilli between them. Length 1 inch, expanse above 1¾ inch. The proportion of colour varies in different specimens, some have only a few orange joints at the base, whilst others are only black beyond the middle of the antennæ; a portion, or the whole, of the 4th abdominal segment is ochreous, as well as the under sides of the coxæ, with no black at the extremities of the hinder thighs and shanks, in other examples.

My calendar is a proof of the abundance of the Death's-head caterpillars in Kent, for I see that all my specimens of this *Ichneumon* were bred or taken at Rochester, Darent, and other localities in that county, I believe in July, one towards the end of that month; but it has been bred from other *Sphingidæ*, I have heard.

ACARI, or Mites.

On the dead haulm of the potato these little creatures congregate for the sake of feeding upon the *Botrytis* or other fungi. One which Mr. Graham found in March, 1846, had been no doubt breeding through the winter, for they often generate in cavities under stones, and a larger and darker species resides in quantities under the tomato leaves in the autumn.

They belong to the ORDER APTERA, the FAMILY ACARIDES, the GENUS ORIBATES, formerly called *Notaspis,* and the potato species is named, apparently by Hermann,

20. O. castaneus. It is as small as a cheese-mite, very glossy, pear-shaped, and of a rusty chestnut colour: the trunk is conical and conceals the head; it is distinctly separated from the body by a transverse channel; the latter is oval and dilated, being very convex with a few long hairs scattered about: the 8 legs are rather long and of a dirty ochreous tint, sparingly clothed with longish hairs, they are 6-jointed; the hips and trochanters are short, the thighs are short and clavate, as well as the shanks, which have a little joint at the base; the foot is elongated but clubbed at the base, and terminated by a single long curved claw.

I have now to give the history of the second army attacking the potatoes, and which is unquestionably an enemy to the cultivator, for these insects subsist upon the tubers and roots, both injuring and reducing the crop.

The potato-disease in France so greatly alarmed the nation on its first appearance, that Monsieur Guérin-Méneville was charged by the Minister of Agriculture and Commerce to draw up a Report, which was read before the Academy of Sciences in October, 1845, and afterwards published in one of the French Journals.* As M. Guérin has also been appointed by the Government to investigate the origin of the disease in the Silkworm caterpillar, called *Muscardine,*† which is a species of fungus attacking living animals, his opinion becomes so important that I may be excused for introducing his observations before I proceed with my disquisitions. In addressing himself to the Entomological Society of Paris regarding "the malady which has for a long time spread itself over the potato-crops," he says, "many persons attributed this epidemic erroneously to insects, whilst it is now demonstrated that it is produced by a malady of the plant, caused by colds which were felt at the end of the spring, and by the extraordinary humidity of the summer, which favoured the production of a Cryptogame that developed itself in great numbers in every one of the cells of the potato. The insects and larvæ that have been found in spoiled tubers have come there when the potato has been partly decomposed by the fungi, and cannot be regarded as having caused the malady."‡

Although I have discovered a great many insects affecting the tubers which are not recorded in M. Guérin's Report, there are many no doubt which have not yet fallen in our way. I shall commence with those which live upon and of course injure the healthy and sound tubers. Amongst these are the

SURFACE GRUBS.

In July, 1844, I received some caterpillars from H. W. B., of Bedminster Lodge, near Bristol, stating that they were all taken on the 26th of July from one plant in a field of potatoes: "They attacked the haulm just beneath the earth and ate through it. Acres of potatoes in this neighbourhood have been attacked by them. Some bore into the potatoes and destroy the small ones. They have also spoiled scores of celery plants and bored into the crowns of the carrots, indeed nothing seems to be free from them." They were the caterpillars of a moth, the *Noctua (Agrotis)*

---

* Bulletin des Séances de la Soc. Royale et Centrale d'Agric., vol. v. p. 331.

† Annales de la Soc. Séricicole.

‡ Ann. Soc. Ent. de France for 1845, vol. iii. p. lxxxvi.

exclamationis, which makes such havoc amongst the turnips, as formerly stated in this Journal.*

TIPULÆ, or Crane-flies.

Any one may readily imagine what an amount of vegetation must be consumed by the maggots or larvæ of these gnats, seeing that during the summer and autumn it is not possible to step on a field or meadow without disturbing a family of the winged parents. Indeed, turnips, potatoes, beet, carrots, and cabbages often suffer as severely from the attacks of Surface Caterpillars, the larvæ of Crane-flies, and the Wire-worms, as from any other insects.

From the beaked head and attitude of the body and legs in flight, the *Tipulæ* have been termed Crane-flies, but in some counties they are better known by the name of Daddy or Old Father Long-legs. As it is mostly in undisturbed ground that the larvæ are propagated to any extent, it is most desirable to keep land clean. Of course weedy banks and hedge-rows will naturally be a harbour for them, as they delight to live amongst the roots under tufts of grass, but their head-quarters are damp meadows and marshes. Wet, consequently, encourages them, and to drown them is impossible, therefore the opposite course, of draining land effectually, would no doubt annoy them more than any other process, and go far towards freeing arable lands, at least, from these universal pests.

The eggs are laid by the females, I apprehend, as they fly, or when they rest amongst the herbage, and are propelled as from a pop-gun. Those of *Tipula Oleracea* are little oval conical grains, shining and as black as ebony; they form a mass occupying nearly the whole abdomen, and I have taken 300 or more from the body of one female (pl. V. fig. 35, *n* an egg magnified). The little maggots hatched from these grow until they are as thick as a small goose-quill, cylindrical, and about an inch long (fig. 36); they are then of an earthy colour and incased in such tough skins that they are called "Leather-jackets." The intestines shining through the back create 2 pale wavy lines, in which a pulse is very evident. When walking or wriggling along, for they have no feet, they protrude their little black horny heads, stretching out the neck, which then tapers, and exposing 2 minute rust-coloured horns and 2 strong black jaws; when in motion their tails are thickest and cut off abruptly, the edges above being furnished with 4 fleshy tubercles more or less pointed, with 2 below, and near the centre are 2 spiracles or breathing-pores (fig. *o*, the stern); they are composed of 13 rings, and when

---

* Vol. iv. p. 106, pl. G, figs. 6 and 7.

drawn up and at rest look like small Bots. From the beginning of May to the first week in August I have observed these larvæ at the roots of scarlet beans, lettuces, beet, and potatoes, and during the same period they are most unwelcome visitors in the flower-garden, where they commit dreadful ravages amongst the roots of dahlias, carnations, &c., and even the grass-plots in the metropolis do not escape, for in Golden-square a few years since the grass was laid bare by them. It is said they come out at night in multitudes to feed, and probably to remove from one locality to another when food becomes short, or it may be in search of convenient places to change into pupæ; at all events they are then secure from the rooks and smaller birds, which would speedily thin their ranks, and the dews of night suit their purpose in every way better than the light and heat of day. Some of the forwardest change to pupæ early in August, perhaps in July, and certainly in September; this takes place under the turf, and even by the sides of gravel walks, if the weeds be left to grow: they are as long and thick as the larvæ, of a similar dirty colour, with 2 slender horns, one on each side of the head; the segments under the belly produce transverse rows of stout spines, and smaller ones on the back, the tail is pointed and spiny; on each side of the trunk are the cases containing the wings, and between them those which enclose the legs (fig. 37). After remaining in this state a short time, the pupa, by means of these spiny rings, works its way through the surface of the earth, the horny covering of the trunk splits down the back, and the gnat crawls forth to dry its wings and harden its limbs, before it takes flight to pair and generate new families. At this time thousands of empty cases may be seen sticking half out of the earth amongst the grass.

The Crane-flies belong to the ORDER DIPTERA, the FAMILY TIPULIDÆ, and the GENUS TIPULA.[*] The species before us was named by Linnæus

21. T. oleracea, from its larva injuring cabbages. It is of a tawny colour, with a bloom over it, giving the fly a dusty appearance. The head is small, almost globose, attached by a short slender neck, the nose forming a stoutish rostrum or beak, acuminated at the apex, and furnished with a short, fleshy, bilobed lip, and 2 longish 5-jointed palpi; the eyes are hemispherical and black; the 2 slender horns are inserted in the face, they are as long as the entire head, tapering, and 13-jointed, the 1st longish, 2nd globose, the remainder elongated and bristly;[†] trunk large, oval, raised considerably above the head, divided into 3 lobes on the back, which is brownish with obscure stripes:

---

[*] Curtis's Guide, Genus 1160.

[†] *Vide* Curtis's Brit. Ent., fol. and pl. 493, for the dissections.

underside hoary, as well as the somewhat orbicular-quadrate scutel: body long, slender, and 9-jointed, clubbed at the extremity in the males (fig. 38, the abdomen, in profile), but it is much longer and spindle-shaped in the female, with the back slate-coloured; the apex horny, pointed, and furnished with 2 lateral tapering lobes, and an oviduct between them: 2 wings, longer than the body, spreading when at rest, rather smoky, with an areolet and 7 cells at the apex; the nervures and a stripe along the costa, including the stigma ochreous-brown; two balancers, long, slender, and clubbed: legs 6, slender, very long, especially the hinder pair, bright ochreous; tips of thighs, shanks, and the terminal joints of the tarsi brown; the claws are curved and acute, with minute pulvilli between them. The male is nearly ¾ of an inch long, and the wings expand 1½ inch; the female (fig. 39) approaches 1 inch in length, and the wings expand nearly 2 inches.

There is another species so closely allied to the foregoing, that it is generally confounded with it: their habits and economy are similar, but they seem to be distinct, and it has been named by Meigen *

22. T. paludosa, implying its partiality to marshy ground. It is of the same size and colour as *T. Oleracea*, but the back of the abdomen is not of a slate-colour, the wings are shorter in the female, as well as her legs, which are also much stouter than those of the male.

The males of the autumnal broods of both species first make their appearance about the commencement of August, and the females are abundant until they are killed by the frosts of autumn. Even in the chilly mornings of October they may be seen, half stupified by the cold, hanging by their fore-feet, their wings covered with dew, and lying flat on their backs, until warmed by the cheering rays of the sun the male takes wing, and the female drags her heavy body and long legs after her as she flies through the grass. The males are attracted by light, as I have seen great numbers come to a lamp at night in September, and the females have been observed at sea in calm weather many miles from land, standing on their legs, with the wings spread, sailing along unhurt. A few appear to be hatched in the spring, and no doubt there would be more, were it not for the larvæ furnishing rooks and many other birds with food during the winter and early spring. This is doing essential service, for in all probability these would produce the parents of the autumn broods, which, it is evident, are sufficiently numerous, notwithstanding the checks upon their multiplication.

---

* System. Besch. Europ. Zweif. Insecten, vol. vi. p. 289.

Their numbers depend very much upon the seasons, and for this reason sometimes these troublesome larvæ are not seen. I believe they abounded in 1816, 17, and 18, and then were lost sight of till 1829 and the two following years, In June, 1845, they committed great havoc amongst some Swedish turnips in the Isle of Anglesea, upon an estate of A. Elliot Fuller, Esq. Wheat and oats are also laid under contribution by them. In a recent number of the Gardeners' Chronicle,* there are some pertinent remarks by Mr. B. Maund, regarding the not growing of wheat after clover-lea, owing to the fly. He says:—

"My attention was called by an agricultural friend to an instance of this last spring, where it was discovered that the plant of spring-sown wheat was dying away, from its being eaten through just beneath the surface of the earth, and that the enemy was the larva or grub of a species of *Tipula*, or Daddy-long-legs. In some parts of the field these were so numerous just beneath the surface, that half a dozen or more could be collected within the space of a square foot; and such devastation had they made, that for half an acre together, in some parts of the field, very few plants of wheat were to be found. The field was rolled three times over in different directions, in April, with Crosskill's clod-crusher, and in a fortnight afterwards, the weather being dry, the land was almost as compact as a macadamised road."

This operation killed many, and saved the crop. Mr. Maund adds:—

"It is not unknown to farmers in the midland counties, that a crop of potatoes cannot be grown on some farms after clover, on account of the existence of this grub; and the only remedy adopted—a most efficient one—is breast-ploughing the turf and burning it."

From the immense swarms of a smaller species of *Tipula* on lighter arable lands, I am inclined to believe that the corn-crops suffer more from these than from the *T. Oleracea* on sandy and similar soils, and as I may not have a better opportunity of making this known to agriculturists, I shall not scruple to introduce the species here, especially as it attacks the potato likewise. The pretty gnat alluded to has been named by Hoffmansegg

23. T. maculosa. The male is not ½ an inch long; the female is more, and the wings expand about 1 inch. They are of a bright yellow colour, spotted with black: the *male* has a pair of slender blackish horns longer than the thorax; the forehead projects like a cone, on each side is a black dot, and on the crown is a black spot pointed over the forehead: the mouth is at the extremity of a cylindrical beak, the feelers blackish; the eyes are black, as well as 3 long patches on the back of the thorax, and various spots on the sides and beneath: the scutel has a conical mark on the back, with a black hinder margin: the

---

* Vol. viii. p. 707.

abdomen is slender, the apex obtuse (fig. 40), with a broken line of 8 black spots down the back; on the underside is a similar line, as well as several black dots at the base: the wings are smoky-yellow, and iridescent, with brown nervures, a yellow pinion-edge, and stigma; the 2 balancers are ochreous and clubbed: the long and very slender legs are ochreous, the extremities of the thighs, shanks, and the very long feet are black. The horns of the *female* are shorter: the abdomen is longer, spindle-shaped, with 6 distinct, black, top-shaped spots down the back, a row beneath, and several dots on each side: the horny ovipositor is ochreous and shining (fig. 41).

These gnats are abundant in fields, gardens, meadows, hedges, &c., during May and June. Sometimes they swarm on the sea-coast, and I remember once, in the middle of May, seeing myriads on the sand-banks in the Isle of Portland, also at the back of the Isle of Wight, and at Lowestoft in Suffolk. Many insects are driven apparently by the wind to the edge of the sea, where possibly their course is arrested by a sudden change in the wind, and they perish in the surf; but no doubt multitudes thus collected escape and generate in the surrounding country. There must be 2 or 3 broods of *T. maculosa* in a year, or else a constant succession of the flies during the summer, for although the month of May seems to be the period when the greatest numbers are hatched, I have bred them in July, but of course temperature has a great influence upon the pupæ.

I have not the least doubt that many species of *Tipulæ* are bred in the field and garden, but the destructive maggots so greatly resemble each other, that they can only be distinguished by actual and careful comparison. A very similar larva is most abundant in the gardens of London, which produces an allied gnat, named by Meigen *Tipula quadrifaria*.

The eggs of *T. maculosa* are oval, spoon-shaped, and black as soot. They must be scattered over the ground as thick as poppy-seeds, for probably not one in a thousand arrives at maturity. The larvæ produced from them are of the same earthy colour as those of the Cabbage Crane-fly, but they are smaller, being only $\frac{3}{4}$ of an inch long, and as thick as a large crow's-quill (fig. 42); they differ also from them in the position and form of the spines; they are wrinkled, and when at rest contract themselves, drawing in the head and thoracic segments, so that this extremity might be taken for the anal end (fig. 43). They are however, able to thrust out their heads and crawl along very well, although they are destitute of feet; the small brown head is furnished with a pair of black jaws, 2 short horns, and I believe minute feelers: 3 pale vessels traverse the sides and back, terminating in a truncated tail with 2 spreading hooks, and 2 short teeth between them, with 2 tubercles below, and 2 fleshy protuberances capable of dilatation and contraction, which materially assist the maggots in locomotion, and in the centre of the stern are 2 large spiracles (fig. *p*). In the spring they change in the earth to pupæ of the like dirty colour, these are about the same length as the larvæ, but scarcely so stout. At this period the head and thorax of the future gnat are defined, but from each side of the latter projects a short slender horn, and beneath the horny case the incipient wings are visible, with the legs placed between them: the abdominal segments have each a transverse row of minute spines above, and 5 large ones beneath, and on either side is an elevated spiny line; the penultimate segment is surrounded by 6 longer spines and 2 small ones, with a large conical process at the tail and a shorter one beneath it (fig. 44).

To ascertain the parents of these grubs or maggots, I paid great attention to them for several years, and some idea may be formed of the mischief they occasion in the field, by the ravages they commit in the garden. On the 23rd of April I found these grubs at the roots of my peas; on the 29th, some had eaten off trusses of the strawberry flowers close to the crown, retiring afterwards just beneath the surface of the earth, and I think it was the same, or the larvæ of *T. Oleracea,* which used to cut through the runners of the same plants: the first week in May they were not uncommon amongst the roots of the lilacs and under tufts of grass; they were also destroying the strawberry and raspberry plants as well as the carrots: on the 28th of the same month I observed some recently transplanted lettuces drooping, and on examination I found the roots separated from the crown a little below the surface, and close by these grubs, which are difficult to detect, owing to the colour and their remaining quite motionless when disturbed. At the end of July they were eating the roots of dahlias, carnations, and various flowers, and on the 7th of August they were observed infesting some potato ground with the larvæ of *T. Oleracea;* after which I lost sight of them.*

We learn, from the 'Introduction to Entomology,' that these larvæ abound in some seasons in Holderness to such an extent, that hundreds of acres of pasture were destroyed by them in the spring of 1813. "A square foot of the turf being dug up, 210 grubs were counted in it;" † and wheats there when sown upon clover-lays suffer severely from these grubs.

Lime-water, it is now said, will not kill these tough larvæ, as it will the thin-skinned earthworm, and the only remedy I have prac-

---

* Gardeners' Chron., vol. vi. p. 317.

† Kirby and Spence, 6th edit. vol. i. p. 148.

tised with success has been to search for them round sickly plants and to dig up all that have been just eaten off by them. This must be done every morning, the earlier the better, otherwise the search may be unsuccessful, for after a short nap the culprit often decamps to feast upon some neighbouring plant. I should think water impregnated with brine, or nitrate of soda and perhaps strong liquid manure, would drive them off and keep the gnats from scattering their eggs in such an uncongenial locality; and if the maggots come out at night, as I have reason to believe they do, soot, sea-sand, and salt, sprinkled over the surface, would, I expect, destroy them; but it must be repeated to prove effectual.

Dickson advises, "When the grub is abundant, to roll the land betimes in the morning in the early spring months, which may crush and destroy them; and when the fly abounds in summer evenings on grass lands or fallows, rolling would destroy them and prevent the deposition of the eggs: they are chiefly deposited in the long grass, on sides of hedges and ditches: such places should therefore be kept free from weeds." He also recommends "Keeping the clover stubbles closely eaten down by sheep or other animals, after the hay has been taken, till the wheat-crop is nearly ready to be put in, which has been found in some measure an effectual remedy against the destructive attacks of the insect."* Children and women might also be employed very advantageously in destroying the parent flies, by hand-picking and sweeping with nets. The farmer must also encourage such birds as render him good and constant service in reducing the insect tribes. Amongst them I shall ever believe that the rooks and starlings, seagulls and lapwings, are most faithful allies, and labourers worthy of their hire. I believe it was Sir Humphry Davy who first stated that jack snipes are very fond of the larvæ of *Tipulæ,* and Mr. Yarrell tells us he has repeatedly found them in their crops. Pheasants also must feed largely upon them in the winter, for Mr. Milton, of Great Marlborough Street, found in the crop of a cock pheasant, in December, 1844, 852 of these larvæ; they were alive, and nothing else was found in the crop, excepting a few oak spangles.† A correspondent also of the 'Sporting Magazine,' writes, "that no fewer than 1225 of these destructive larvæ (wireworms?) were taken from the crop of a hen pheasant in January."‡ No doubt these birds pick out the larvæ in corn and turnip-fields, and when it is remembered, that the almost incredible numbers contained at one time in the stomach, only made a single meal, the extent of their services may in some measure be estimated.

---

* Practical Agriculture, vol. i. p. 555.

† Gardeners' Chron., vol. iv. p. 814.

‡ Vol. iv. p. 45.

WIREWORMS.

As no crop is perhaps altogether free from these destructive larvæ, we need not be surprised at their inroads upon the potatoes; indeed wireworms seem to be especially fond of them, since there is no better trap than slices of potato stuck in the ground and covered with earth, to be examined daily. In this way every wireworm may be attracted from a flower-bed and destroyed.

I do not apprehend that a potato-crop is ever entirely destroyed by wireworms, although when young they bore up into the haulm, as observed by Mr. Graham, and the sets also are stated to have been greatly injured by them in May; but they undoubtedly diminish the value of the tubers materially by perforating them, and thus rendering them a suitable nest for other insects. Towards the end of last September the potato-crops in this parish were greatly infested in some localities by wireworms, millipedes, and centipedes. A gentleman near Tadcaster* has suggested that potato-crops may even attract the wireworm. It appears from our correspondent, that "in 1844, in order to clean and redeem 7 acres of exhausted land, it was planted with potatoes after oats: the potatoes did not suffer from the wireworm, the crop was as good as could be expected, considering that the great dryness of the season had delayed the planting till June. In March, 1845, 6 acres were sowed with oats, 1 acre having been dibbled with wheat in December. The crops were most healthy, but subsequently patches of decay attracted attention, and it was soon found that the wireworm had been at work to so fearful an extent, that in ten days the whole crop seemed victimised. Soot was then applied to 4 acres (16 bushels per acre), and not being able to obtain more, the remainder was sown broadcast with guano, at the rate of 2 cwt. per acre, all applied in a pouring rain. This arrested the evil, and many of the patches, apparently destroyed, struck up a second growth from about half an inch below the surface, where the wireworms had bored through the shoots, and the oats eventually became the best crop in the parish."

Mr. Duncombe also says—" On seeing the change for the worse in the oats, when averaging about 6 inches growth, I applied myself to discover the cause: I carefully removed the soil from very many plants and rows, for death seemed to go by rows for several yards together. I collected a paper full of wireworms, and uniformly found not a rotten but a dry mouldy potato or potatoes: some which were not so advanced were full of wireworms. Hence I conclude that the potatoes left in 1844 either bred or attracted from a distance these pests to my oats in 1845. If I had not

---

* The Rev. E. Duncombe, of Newton Lyme.

planted potatoes in 1844, or if I had collected every one on taking up the crop (which I believe to be out of the question), I am fully persuaded in my own mind that I should have had no wireworm; and their numbers in the roots of anemones, on ground where I never can detect wireworms without such roots, induce me to incline to the opinion that gardeners and farmers cause the evil by neglecting preventives."

Here we have additional evidence of the taste which wireworms evince for potatoes. The tubers left in the ground attracted them to certain spots where they perforated the potatoes and caused their decay. If therefore these potatoes could have been collected before the oats were sown, the crop would have been saved from their incursions. When the first crop of oats was grown, they were probably too young to commit much if any apparent mischief, for I cannot think they came from any distance; if such were their habits, they must ere this have been observed when migrating at night. These remarks of Mr. Duncombe also show the value of soot in recovering crops from the attacks of the wireworms.

In the department of the Moselle, in France, wireworms are very common, and near Metz great numbers have been found by M. Rayer, the Inspector of Agriculture, both in sound and diseased potatoes.* It is worthy of remark that they are a very different wireworm to our common one,† being more like that of *Elater murinus* and *E. lineatus* of Bouché,‡ clearly showing that various wireworms feed upon potatoes, all of them making numerous holes and burrows in the tubers, both causing and hastening their decay.

An entire Report having been devoted to the wireworms, when the turnip-crops were under consideration, with descriptions and figures of all the species, it is unnecessary here to enter further upon their economy,§ and for the same reasons the false wireworms will not long detain us.

SNAKE MILLIPEDES

are found in large numbers in potatoes, as soon as symptoms of decay appear, especially in September, and they consequently complete the destruction which the wireworms began. *Iulus Londinensis* and *I. terrestris*‖ are two of the snake millipedes, which are said to be injurious to early crops in the winter. During frosty and cold weather they lie curled up in the earth, but so slight a degree of warmth is required to awaken them from their torpor, that by merely breathing upon them for a few seconds they awaken from their slumbers, and move about with their accustomed glid-

---

* Bulletin des Séances de la Soc. Roy. et Cent. d'Agric., vol. v. p. 331.

† Journal of Royal Agric. Soc. vol. v. pl. I. f. 2.

‡ Ibid., pl. J. f. 40 and 42.

§ Ibid., vol. v. p. 180.

‖ Ibid., vol. v. pp. 228 and 229, pl. J. f. 54.

ing gait. They seem to congregate in autumn, and as they are very fond of fruit, vast numbers may be collected by putting slices of apples under tiles or in baskets of moss: upwards of forty have been taken from one slice: but these modes of catching them can only be practised in gardens; I expect, however, if cabbage leaves were scattered along the furrows in damp weather, that they would be nearly as attractive. The most abundant and mischievous species both in England and France is the *Iulus pulchellus*,* called in some French works *Blaniulus*, from the indistinctness of the eyes or their entire absence. It was reported to have destroyed the potato-sets at Derby in April, 1845, and I have frequently found multitudes in partially diseased potatoes the beginning of October, when they were generally accompanied by *Polydesmus complanatus*, which has also been figured and described in a former volume.†

CENTIPEDES OR SCOLOPENDRÆ.

A large amount of these curious animals inhabit the earth, *Lithobius forcipatus* and *Geophilus electricus* (?) being the most usually met with. The former of these is said to be entirely carnivorous, and the latter will attack allied species as well as each other. Such being the case, they are probably useful in reducing the ranks of the various soft larvæ which affect the roots of plants. It is certain that they are very abundant in potato-grounds, and Mr. Hope "attributed the potato disease to the attacks of the wireworm, and also to a small *Scolopendra*, which he had found in myriads infesting diseased potatoes at Southend."‡ I observed them in rotten potatoes in August, 1845, and in September last the *Geophilus electricus* was running about in every direction when the potatoes were forked out. Vast quantities of the sound tubers had been perforated by the wireworms, some of which were found inside, and the cavities were often enlarged by slugs.

These animals, which, like the millipedes, are not true insects, belong to an ORDER called CHILOPODA, and to the FAMILY SCOLOPENDRIDÆ. They were all included by Linnæus in the GENUS SCOLOPENDRA, but from variations of structure one is now called

24. Lithobius forficatus, the 30-foot. It is nearly 1 inch long and 1⅓ line broad; smooth, shining, horny, of a ferruginous or ochreous colour, sometimes brown: it has 2 longish tapering horns, composed of upwards of 40 minute joints: the head is large and orbicular, armed with powerful jaws like a pair of claws, having a small group of granulated eyes on each side: the body is flattened and linear, composed of 16 plates like scales, alternately

---

* Journal of Royal Agric. Soc., vol. v. p. 228, pl. J. f. 53. Guérin considers this to be the *I. guttulatus* of Fab.: Supp. to his Ent. Syst., p. 289.

† Ibid., p. 230, pl. J. f. 55.

‡ Trans. Ent. Soc., vol. v. p. 136.

quadrate and narrow: it has 15 pair of bristly and spiny legs, the hinder pair being the longest, they are 7-jointed, curved, tapering, and terminated by a minute conical claw.

The other species may prove to be the true *Scolopendra electrica* of Linnæus; it belongs to the Genus *Anthronomalus* of Newport,* and is certainly Leach's

25. Geophilus longicornis. This species is from 2½ to 3 inches long, and not more than ½ or ⅔ of a line broad. It is shining bright ochreous: the head is oval with a strong jaw on each side terminating in a sharp blackish claw: eyes none; horns thrice as long as the head, like 2 hairy threads, composed of 14 joints, decreasing to the apex: body composed of a multitude of transverse segments, with from 51 to 55 pair of short legs, the hinder pair not longer than the others; the claws long and slender (fig. 45).

These creatures move with a very waving motion from right to left, doubling when they turn, and this as well as a few other species have the very extraordinary power of secreting a phosphoric fluid, which the animal leaves behind as it walks, so that when it is dark one sees a luminous broken line of light, sometimes 2 or 3 feet long. This phenomenon is generally noticed in autumn and spring, and is supposed to be most active when the animals are pairing: whether the fluid is secreted by both sexes seems doubtful, and if they be quite blind, the light must be bestowed upon them for reasons which as yet remain hidden from us. Their economy is likewise very interesting, for Mr. Newport has proved that "the female deposits her eggs, from 30 to 50 in number, in a little packet, in a cell which she forms for them in the earth, and never once leaves them until the young are developed, which is at the end of about a fortnight or three weeks. During the whole of this time she remains in the cell, with her body coiled around the eggs, incubating them and constantly turning and attending to them."† They hybernate in the earth during the winter, and subsist partly on succulent roots, ripe fruit, and decaying vegetable matter, only coming out at night, apparently in search of food.

We have now arrived at the second section of our subject, relating to the various insects and allied animals which are found amongst the potatoes when decomposition has commenced. They amount to a very considerable number, and yet probably not half of them have been noticed, for whilst those recorded by M. Guérin comprise nine different sorts, the species detected in this country are twice as many.

In February, 1846, a *Podura*, probably the *P. plumbea* of

---

* Trans. Linn. Soc., vol. xix. p. 430.

† Ibid., vol. xix. p. 428.

Linnæus, was abundant, skipping about the rotting potatoes, with its beautiful iridescent scaly coat, and in the cavities were numbers of a milk-white *Ricinus,* with multitudes of an ochreous *Acarus* allied to *A. coleoptratus.*[*] M. Guérin also describes and figures an *Acarus* called *Glyciphagus fecularum,*[†] and another which he names *Tyroglyphus feculæ,*[‡] both of which were found in the changing potatoes or in cavities of the diseased tubers.

The species, however, which I found most abundant upon them, was the *Acarus farinæ,* which also swarms in meal and flour, when kept for any length of time, especially in damp places, and it is very remarkable that the same species seems to delight in worm-eaten wine-corks, for they have been sent to me from many cellars. In February, 1846, they were most abundant in decaying potatoes, and in March, 1847, they were observed by the Rev. L. Vernon Harcourt, near Chichester, and by Mr. Graham, of Cranford. Being very white, they may swarm, as they often do in flour, before they are discovered, and no doubt they feed upon the starch and farinaceous portions of the potato. The mites vary so greatly in their structure, that the old Genus *Acarus* has been split into many Genera, and the one to which this species belongs is now called

26. Tyroglyphus farinæ (fig. 46, magnified), being synonymous with the *Acarus farinæ* of De Geer.[§] It is like a minute globule of fat, being of a pellucid shining white, with a rusty cloud on the back of some specimens, and it is not larger than a very small grain of sand (fig. *q*) : it is oval, the anus slightly concave ; it has some longish rusty hairs scattered over the body, and the head and legs are of the same colour : the thorax is small and but slightly indicated ; the head and mouth form a horny cone : the 8 legs are short, stout, and tapering, the 1st and 2nd pair incline forward, the former arise close to the head, the latter are attached to very large white scapes forming the base, the other two pair are inserted at the middle of the belly and incline backward ; they are all 6-jointed, the joints subquadrate or oblong, pilose, the penultimate producing a few long bristles and terminated by a strong hooked claw.

They walk with tolerable alacrity and delight to burrow head foremost into the flour. I have eaten pie-crust made of meal in which myriads of these mites were generating, and found no ill effects from the food. The meal was first spread on the top of an oven to dry, by which process I found that a small degree of heat killed them.

---

[*] Gardeners' Chron., vol. iv. p. 316.

[†] Bull. des Séan. de la Soc. Roy. et Cent. d'Agric., pl. 5, f. 7.

[‡] Ibid., pl. 5, f. 9.

[§] Mémoire de l'Hist. des Ins., vol. vii. p. 97, pl. 5, f. 15.

In the potatoes with the *Acari* were larvæ of various little beetles which assist in reducing putrid substances to a simple state, which is indispensable for supplying the soil again with the proper elements as food for the support of vegetation. One of them was very similar to the larvæ of a beetle called *Dermestes*, but only 1½ line long; another, a little larger, would undoubtedly produce some beetle of the families *Carabidæ* or *Staphylinidæ*. A somewhat similar larva was found in France, which Guérin believes may belong to a Genus of little Rove-beetles,* called *Calodera*.† Another kind was detected by M. Rayer, which is likewise supposed to belong to one of the *Staphylinidæ*.

Nests also of little creatures were found in rotting potatoes, which looked like black mites, but on close examination they proved to be beetles—members of a Family entirely devoted to the consumption of putrid animal and vegetable substances. I allude to the FAMILY HISTERIDÆ; the species from the tubers belongs to the GENUS ABRÆUS,‡ and was named by Fabricius

27. A. minutus. It is a little oval, convex, shining beetle, like a seed, and not more than ½ a line long, often only ⅓: it is of a dark chestnut colour: the head is bent down, the feelers being visible but not the jaws, and in front are 2 short, curved, 11-jointed horns, terminated by a distinct somewhat oval club: the eyes are small and lateral: the thorax is very broad and punctured; the scutel is invisible: the elytra are broad, semi-oval, not covering the rump, beneath them is folded a pair of wings: the 6 little slender legs lie close to the body in repose; the anterior shanks are flattened, and the 5-jointed feet are short and very slender.

In the early spring these beetles are found under dung, and in September I have observed them in ripe and decayed cucumbers in frames, where sometimes they are generated in thousands, the warmth favouring their increase.

A still more minute beetle was detected amongst the potatoes, called *Trichopteryx rugulosa*;§ it is not larger than this dot . being scarcely visible to the naked eye, nevertheless its pair of horns and six legs are complete, and the beautiful wings with a long fringe are most marvellously folded up under the wing-cases when not in use.

I have repeatedly found small Rove-beetles in the rotten potatoes, where I expect they live upon the *Acari* and minuter animals, but of this I have no evidence. Guérin likewise thinks it probable that their *larvæ* may live upon those found in the rotten

---

* *Vide* Journal of Royal Agric. Soc., vol. iv. p. 126, pl. H. f. 28 and 29.

† Curtis's Guide, Genus 219^{b}.

‡ Curtis's Guide, Genus 142, No. 2.

§ Bull. des Séances de la Soc. Roy. et Cent. d'Agric., pl. 6, f. 3, and Sturm's Deutsch Fauna, vol. xvii. pl. 320.

portions of potatoes. One of the species is very widely spread in the autumn, and lives through the winter: it is named by Gravenhorst *Staphylinus nitidulus*, and is now called

28. Oxytelus nitidulus.* It is only 1¼ line long, narrow, flat, shining black, and coarsely punctured: the head is broad with several depressions, the oral organs are visible and the eyes prominent; before them are inserted the 2 horns, which are not longer than the thorax, thickest at the extremity, the 1st long and clavate, 2nd small, 3rd minute, the remainder like strung beads, increasing in size, the terminal joint ovate-conic; the thorax is broader than the head, somewhat semi-orbicular, with three channels down the back: the elytra are quadrate, chestnut-coloured, black at the base, and appearing striated from short depressed hairs: body nearly as long as the remainder of the insect, intensely black and glossy, elliptical, with 7 distinct segments, the sides margined and pilose, the tail triangular: wings ample, folded beneath the wing-cases: 6 legs short and tawny; thighs thickened and rather pitchy in the middle; shanks flattened and serrated, excepting the hinder pair, which are slender: anterior notched outside near the apex; feet composed of 3 or 4 short and 1 long joint with a pair of slender claws.

These insects are also found in decaying cucumbers, melons, and various vegetables; they frequent muck-heaps and breed in the dung of animals.

POTATO FLIES.

Dead and silent as the earth appears to be, it teems with life, for not only is the soil full of seeds, which merely require light and heat to start them into life, but it must abound with the eggs of insects, so minute, that even with the assistance of a lens they escape one's notice. To be convinced of the truth of this, if a flower-pot be filled with mould from a field or garden, and then tied over with the finest muslin, the experimentalist will be astonished to find the multitudes of little flies which are constantly making their appearance, bred no doubt from larvæ nourished on the vegetable matter which such soils contain. Where crops are grown and any portion of them becomes decayed, the number of these minute insects is vastly multiplied, and thus where the diseased potatoes have existed, additional swarms of various little flies have been the consequence. As a proof of the incredible numbers that must be thus generated, I may mention that from one growing and partially rotten potato I bred, in August, 1845, 128 flies, independent of many more which had died in the pupa state, or been destroyed by damp and mites

---

* Curtis's Guide, Genus 216, No. 16.

before I discovered them in the vessel in which the tuber was placed, as well as multitudes of smaller flies, all of which I will now describe.

The whole belong to the ORDER DIPTERA: the first I shall notice is included in the FAMILY TIPULIDÆ, and the GENUS PSYCHODA, and has been named

29. P. nervosa (fig. 47; *r*, the natural size *). The males are twice as large as the females: they are ashy-white, clothed with longish wool: the little head is buried under the thorax: the black eyes are large and lunate: the 2 horns are as long as the thorax and composed of 11 (?) small joints, black at the base, giving them an annulated appearance: the abdomen is short and of a dirty colour: the 2 wings when at rest meet over the back slanting: they are iridescent, very large, oval, and lanceolate, with numerous longitudinal hairy nervures: the entire margin is also hairy; balancers small, clubbed, and white: 6 legs woolly; the feet 5-jointed, the tips black. Length ⅔, expanse 3 lines.

In February, 1846, the larvæ and pupæ were abundant in the rotten potatoes, also in decaying leaves and dunghills, and the flies have been bred by Mr. Haliday from putrescent fungi. These flies sometimes swarm in outhouses and about drains in spring and autumn.

The larvæ are not ½ a line long, yellowish-white, cylindrical, spindle-shaped, with 11 distinct annulations besides the head, which is triangular; the tail is elongated and tubular. The pupa is about ⅔ of a line long, ochreous, and ferruginous; it is elongate-ovate in repose (fig. 48, the back; 49, the underside; *s*, the natural size), but the body can be stretched out and attenuated when disturbed, as in fig. 50: from the forehead project 2 slender appendages, like horns, on either side are laid the short stout antennæ, and the wings meet over the breast, with the legs stretched out between them: the abdominal segments are ciliated and the tail is forked.

Several species of a little swarthy two-winged fly were bred from the decaying potatoes in multitudes. They are called *Sciara* by Meigen, and *Molobrus* by Latreille. The larvæ I received from Mr. Graham: they are slender worms, about a quarter of an inch long, whitish and opake, but when immersed in water they become perfectly transparent, exhibiting the ochreous viscera and the food digesting in the stomach; when in motion they taper towards the head, which is oval, horny, black and shining; the body is composed of 13 segments with 7 or 8 spiracles on each side; the tail is broad and rounded, but slightly pointed in the centre (fig. 51; *t*, the natural size). The pupa is

---

* Curtis's Guide, Genus 1151, No. 6, and Brit. Ent., fol. and pl. 745.

shorter, cylindrical, elliptical, and of a dull ochreous tint, becoming darker as the period approaches of the birth of the fly: the antennæ, eyes, wings, and legs are visible beneath their horny sheaths (fig. 52; *u*, the natural size). At this period they are deprived of locomotion, but the larvæ, although perfect maggots and destitute of feet, are able to move along in moisture, at the same time waving about and thrusting out their heads with great energy. There are 30 species of these flies which inhabit England, and 3 or 4 of them have been bred from putrid potatoes. One is called

30. Sciara fucata, *Meg.*;* when alive it is 1 line long. The *male* is of a pale inky-black, the head is small and spherical, with 2 tri-articulate feelers bent under; the 2 horns are not longer than the thorax, tapering, pubescent, inserted in front of the face, and 16-jointed, 2 basal joints the stoutest, the remainder oblong, apex conical; eyes lateral, kidney-shaped, and coarsely granulated; ocelli 3, but unequal: trunk gibbose, subquadrate, scooped out at the base, with two indistinct lines of short ochreous hairs down the back; scutel lunate, postscutel oval, of a greyish colour: abdomen slender, greenish black, brownish after death, 7-jointed, the margins of the segments pale, apex obtuse, and furnished with 2 incurved bi-articulate lobes: 2 wings, incumbent in repose, parallel, longer than the body, iridescent, slightly smoky, but transparent and clear at the base; nervures brown, excepting the central one, which is scarcely visible, but forked and dark at the margin; the costal nervure does not reach the base of the forked cell: balancers pale dirty yellow or ochreous: 6 legs, long, slender, and of a dirty yellow or pale olive tint. *Female* similar, but larger, being 1½ line long, the wings expanding nearly 3 lines: the thorax is not narrowed behind: the abdomen is spindle-shaped, attenuated, and conical, terminating in 2 little parallel sheaths: the 2 balancers are dusky when dry.

This was bred in the winter of 1845-46, and again in 1848, in vast quantities: the flies are also found throughout the summer in fields and gardens, on umbellate flowers, and on grasses. I have likewise bred them from rotten turnips in March.

31. S. quinque-lineata of Macquart† is 1⅓ line long (fig. 53, the female; *v*, the natural dimensions). "It is black, with 5 lines on the thorax of a deep dull grey: anterior hips testaceous: wings almost hyaline:" balancers brown or dirty white.

Specimens agreeing with this description were bred from rotten potatoes in March, 1848, and sent to me with the tubers con-

---

* Meigen's Syst. Besch. Europ. zweif. Inseck., vol. i. p. 280, No. 6, and Gardeners' Chron., vol. v. p. 784.

† Hist. Nat. des Ins. Diptères, vol. i. p. 149, No. 10.

taining the larvæ and pupæ also, which resembled figs. 51 and 52. The potatoes were like old rotten cheese, and portions of the outside were covered with slimy threads, which Mr. Graham saw the larvæ spin. He thinks they cause the 'scab' in potatoes, but I saw not the least vestige of the insect on one variety of my potatoes, which was very scabby.

32. S. pulicaria? *Meigen,*[*] *Hoff.*, is ½ a line long or upwards, and is distinguished from the two foregoing species by its longer antennæ, which are equal in length to the rest of the body. "It is black, with testaceous legs: the wings almost hyaline: balancers brown."

My specimens being as big again as Meigen's, with ochreous balancers, I am doubtful if they be the *S. pulicaria* of that author. I bred them in August, 1845, from a rotten potato.

Another Dipterous insect was bred from the potatoes in less quantities. It also belongs to the FAMILY TIPULIDÆ, and the GENUS SCATHOPSE. It appears to be Meigen's

33. S. punctata.[†] It is black and shining: the head is small; the eyes are kidney-shaped, with 3 little ocelli on the crown; the antennæ are short, stout, cylindrical, and composed of 11 cup-shaped joints: thorax elongated and somewhat compressed, with a white dot on each side; scutel small and rough: abdomen broad, oval, and depressed: wings ample, resting horizontally, transparent, and iridescent, with a black costal, subcostal, and basal nervure, the 1st and 2nd united beyond the middle, and divided near the base, by an oblique nervure; there are also 4 other very faint longitudinal nervures, the apical one forked, the anal one waved: balancers yellowish: legs simple, longish, and rusty; extremity of thighs and shanks variegated with fuscous; feet brown, 5-jointed, terminated by a pair of minute claws. Length 1¼ line, expanse 3½ lines.

The larvæ from which these flies proceed, live in various putrid substances, and even in dung: they have also been bred from the cocoons of silkworms, in all probability containing decomposing caterpillars or rotten pupæ; they are from 2 lines to nearly ¼ inch long, flat, and narrowed at both ends, of a dirty greyish-yellow colour; the head is brown and oval, with 2 short feelers: the body is composed of 12 pubescent segments, the 1st thoracic one with a prominent spiracle on each side, as well as the penultimate, which with the apex is covered with radiating bristles. The pupa is 1½ line long: it is enclosed in the skin of the larva, a little depressed, and yellowish brown: from the thorax projects a branched spiracle, like a buck's horn, and the tail

---

[*] Syst. Besch. Europ. zweif. Inseck., vol. i. p. 282, No. 12.

[†] Ibid., vol. i. p. 301, No. 4, and Curtis's Guide, Genus 1177, 3.

has a stout spine. It remains from a week to a fortnight in this state, and the flies are often exceedingly abundant in the autumn.

Two large flies belonging to the FAMILY MUSCIDÆ I also bred from a single potato, as previously stated. There were 48 specimens of one which was named by Fallen

34. Musca stabulans.* The *male* is 3½ lines long, and the wings expand ½ an inch: it is of an ash-colour, and clothed with black bristles; the feelers are ferruginous; the antennæ drooping, 5-jointed and rust-coloured, pitchy at the base, 3rd joint elliptical and hoary, except at the base, the seta black and feathery, the basal joint minute: eyes large, approximating, naked, and chestnut colour, the margins silvery white, as well as the face, with a black stripe tapering from the antennæ to the 3 ocelli on the crown: thorax hoary, with 4 black longitudinal stripes before, the 2 central ones the longest, with a spot on each side beyond the centre; scutel hoary, with a dark stripe at the base, ferruginous at the tip: abdomen ashy-ochreous, shining, the back variegated with brown patches: wings with the apical cell not angulated, but suddenly rounded, scales at the base with pale tawny margins, and concealing the ochreous clubbed balancers: legs black, apex of thighs and tibiæ ferruginous; pulvilli at the extremity of the feet elongated. *Female* similar, but the eyes do not approximate, the face has a yellow tinge, and the stripe on the crown is broad and elliptical: the abdomen is broader, with an oviduct at the tail, and the pulvilli are small (fig. 54; *w*, the natural size).

The maggots had bred and accumulated amongst the slimy matter of the rotting potato just as meat-maggots are found, together with the horny pupæ. Indeed, the largest maggots were exceedingly like those of the flesh-flies, being fat and whitish, the ochreous food and white lines of viscera shining through the transparent skin: the head was pointed with a black proboscis formed of 2 horny claws, and the two spiracles at the blunt tail were like 2 black horny knobs (fig. 55). The tough and oval pupæ were of a bright chestnut colour, the segments slightly marked, the head end rounded and wrinkled to a point, the tail furnished with 2 black spiracular tubes (fig. 56).

Of the other fly I bred 58 specimens from the same potato the middle of August. The larvæ escaped my notice at first from being so very like the earth in colour, and they are still more difficult to detect from their sluggishness. They must be in the greatest force in July, but I have met with them in rotten potatoes the end of November. The group of flies with these singular spiny larvæ have been formed by Bouché into a GENUS

---

* Meigen's Syst. Besch. Europ. zweif. Inseck., vol. v. p. 75, and Curtis's Guide, Genus 1286, No. 23.

called HOMALOMYIA,[*] being a section of *Anthomyia.* The parent fly of our species is exceedingly like *Musca canicularis* [†] of Linnæus; still there are differences, and as the larvæ are also dissimilar, I have named this Potato-fly

35. Anthomyia tuberosa.[‡] The *male* is 2½ lines long, and expands 5½: it is greyish-black and bristly: the eyes are chestnut colour, naked, approximating on the crown, the inner margin silvery white; antennæ drooping, 5 jointed, 3rd joint oblong, 4th a slender elongated basal joint to the longish pubescent seta: thorax with 5 indistinct broad stripes down the back, 2nd and 3rd abdominal segments with bright ochreous spots on each side, 3rd rarely with 2 similar minute spots: wings transparent, nervures dark, the 2 transverse ones not very remote: balancers pale tawny: legs black, base of shanks indistinctly ferruginous (fig. 57; *x,* the natural dimensions). *Female* ashy slate colour: the eyes smaller than those of the male and remote; the face not silvery: thorax with 5 distinct broad blackish lines down the back: abdomen ovate-conic, with 2 indistinct ochreous slightly diaphanous spots on the 2nd abdominal segment; in other respects this sex is similar to the male.

The larvæ, although indolent, can crawl well; they are of a dull tawny colour, clothed with long bristly spines, somewhat depressed, elliptical, tapering to the head, which is waved about, and when thrust out is whitish and fleshy, armed with 2 minute hooks like ebony, and there is a little fleshy horn on each side, on the following segment is a spiracle, on either side, surrounded by several stout short rays, the 2 next segments have tubercles on the back, the remainder have a double series down the centre producing bristles, with a double row on each side, and 8 of the segments have a pair of short spines on each beneath, which enable it to walk; the apex is armed with 6 long bristles a little spiny at the base, but most of the others are naked, or with the slightest appearance of pubescence or little spines at the base; on the apical segment are 2 spiracular tubes (fig. 58; *y,* the natural size). The pupa being formed within the indurated skin of the larva, it varies from it only in being more convex above, and the fly escapes by a lateral opening in the thorax.

These larvæ and pupæ I find occasionally in my garden where cabbages have long occupied the ground, and Dr. Harris remarks that the hairy maggots of *Anthomyia canicularis,* or an allied species, live in rotten turnips;[§] they also abound in privies, and

---

[*] Natur. der Inseckten, p. 89.

[†] Curtis's Guide, Genus 1287, No. 104.

[‡] Gardeners' Chron, vol. v. p. 817.

[§] Treatise on Insects injurious to Vegetation, p. 414.

the pupæ cases are sometimes found in multitudes under the boards.

From the large quantities of these maggots which have been ejected from the human stomach and intestines, accompanied by the most distressing symptoms,* I am led to conclude from their economy, that the eggs or larvæ are conveyed into the stomach in badly or half-cooked vegetables, for it is evident they subsist upon decomposing vegetables and excrementitious substances, and I have found similar but very small larvæ on cabbage-leaves in October. It is therefore very probable that under certain morbid conditions of the constitution they are able to live in the human body until they have arrived at their full growth, when they are necessarily ejected to become pupæ, and after a short time to be transformed into flies. It is not a little remarkable that the maggots of *Musca stabulans* should have been also voided from the intestines,† and that fact tends to substantiate the view I have taken of the subject, and the cause of their presence in the human system, for that is the other species of large fly which I bred from maggots generated in the same potato.

I also detected the larvæ and pupæ of a smaller species of fly called *Drosophila*, which hatched the middle of August with the foregoing insects. They are also inhabitants of cellars, as their specific name implies, where the larvæ are usually very abundant all the year round. They will breed in stale beer, and probably are generated where there is any leakage from the tap and oozing about the bung, as well as from the fungi which spring up round rotten wood, &c., in cellars. I have also known them to be bred from vinegar,‡ and it will be remembered that one species, *D. flava,* lives on the pulpy substance of the turnip-leaves,§ and another, *D. graminum,* I have bred from cabbage-leaves. In spring and autumn the flies abound, and are not unfrequently on the inside of our windows. They belong to the FAMILY MUSCIDÆ, and the GENUS DROSOPHILA. That bred from the potatoes appears to be the Linnæan species named

36. Drosophila cellaris. It is 1½ line long, and expands 4 lines: the general colour is ochreous: the head is broad as well as the face, in the centre of which are inserted the 2 little drooping pubescent horns, the 3rd joint is oval, and from the back arises a feathery bristle jointed at the base: the orifice forming the mouth is very large; eyes large, hemispherical; ocelli 3 on

---

* Iliff, in Lancet for July 25th, 1840; Trans. Ent. Soc., vol. ii. pp. 152 and 256, pl. 15, f. 19; Memoirs of Med. Soc. of London for 1789, vol. ii. f. 1—4.

† British and Foreign Medical Review for April, 1842.

‡ Curtis's Brit. Ent., fol. and pl. 473, and Curtis's Guide, Genus 1334.

§ Journal of Royal Agric. Soc., vol. iii. p. 69, pl. D. f. 30.

the crown: thorax globose-quadrate; scutel semi-ovate: abdomen small, depressed, oval, blackish, and 6-jointed, with 4 or 5 ochreous bands; the apex pointed in the female: wings incumbent in repose, very long and ample, yellowish and iridescent, with a very short marginal cell, and 4 longitudinal nervures, the 2nd and 3rd united towards the base, the 3rd and 4th towards the margin; balancers small, clavate: 6 legs tapering; feet long, slender, and 5-jointed, terminated by minute claws (fig. 59; *z*, the natural dimensions).

The larvæ are 2½ lines long, of a whitish colour, tapering towards the head, composed of 12 joints; on each side of the thoracic segment is a short branching spiracle, and the tail is furnished with 4 divaricating blunt spines, the edges of the segments being serrated with hooked ones (fig. 60; a, the natural size). When full grown, this skin becomes horny, changing to a rust-colour, the maggot is transformed to a pupa within an internal horny shell of a chestnut colour, and of course the pupa (fig. 61; b, the natural size) greatly resembles the larva.

There is also an extensive group of flies called *Borborus*,[*] the larvæ of which live upon decomposing vegetable, and probably animal substances also: at all events they are generated in fungi. A portion of these flies is now distinguished by Macquart under the generic name of LIMOSINA;[†] one of them I have bred from rotting potatoes, and it seems to be identical with that author's

37. L. geniculata.[‡] It is only 1 line long, and expands a little more than 2 lines. It is black; the head is moderately large, with an ample cavity beneath to receive the mouth: the eyes are hemispheric and rust-coloured, and there are 3 minute ocelli on the crown; the face is concave, with 2 little horns in the centre, the 3rd joint orbicular, with a tomentose seta: thorax broader, very convex; scutel semi-orbicular and flat: abdomen very short, the segments equal in length: wings rather small, smoky, nervures pitchy; costal the strongest; submarginal cell not extending to the apex, 2nd and 3rd longitudinal nervures united at the middle, 3rd and 4th forming a loop with 2 minute branches at the extremity; balancers small and ochreous: legs pitchy; hips ochreous, as well as the tips of the anterior thighs and the base of the shanks; hinder with a few spines outside; feet long, 5-jointed, especially the hinder, which are slender, and longer than the shanks; dull ochreous, basal joint very long and pitchy, terminal one very short, and furnished with short claws.

M. Rayer also observed a species in the infected potatoes which

---

[*] Curtis's Brit. Ent., fol and pl. 469.

[†] Curtis's Guide, Genus 1350.

[‡] Macquart's Hist. Nat. des Diptères, vol. ii. p. 572.

has been named by Guérin *Limosina Payenii,*[*] and it is not improbable that it may be the male of Macquart's species, for it agrees very well with our female, except in the colour of the wings and the structure of the hinder feet.

With the foregoing *Diptera* I often bred a parasitic insect in considerable numbers, but to which it is attached, or whether to any of them, I am unable to ascertain. It belongs to the ORDER HYMENOPTERA, the FAMILY PROCTOTRUPIDÆ, and the GENUS CERAPSILON, which has been divided by Mr. Westwood into 3 Genera, one of which is called *Paramesius,*[†] and to that section our insect belongs. It is included by Nees ab Esenbeck in the *Genus Diapria,* and has been named by him

38. P. brachialis.[‡] The *Male* is scarcely 1 line long, and expands 1$\frac{2}{5}$; it is very glossy black; the head is globose; the face short ovate, and at the bottom are attached the antennæ, which are nearly as long as the body, ferruginous, and 14-jointed, basal joint long, 2nd short, obovate, 3rd notched or comma-shaped, remainder short and obovate, apical joint conical; eyes small, lateral, with 3 ocelli on the crown in a triangle: thorax very globose, scarcely larger than the head: scutel small, semi-oval, deeply hollowed at the base; metathorax ferruginous and uneven; petiole forming a ferruginous knob, woolly behind: abdomen small, ovate-conic, pitchy, base ferruginous, with 4 longitudinal channels on a very large segment, apical segment very short: 4 wings dusky and pubescent, with a few nervures at the base of the superior, forming an elongated cell: 6 legs short, slender, and ochreous, pitchy at the base; thighs thickened, as well as the anterior shanks, and pitchy at the middle; feet slender, 5-jointed, tips dusky. *Female* above 1 line long, and expanding 1$\frac{3}{4}$: this sex is not only distinguished by its larger size, but the horns are shorter, with only 12 joints, the 3rd being simple like the 2nd; and the extremity of the abdomen is acuminated, and very acute.

This insect belongs to a family which is very serviceable in keeping down wireworms and other subterranean larvæ, as will be seen by a reference to a former volume[§] and the 'Gardeners' Chronicle.'[‖] Nees also says that the *Diapriæ* breed in the subterranean larvæ of *Tipulæ,* or Gnats.

I must not omit to record another fly called *Dilophus febrilis,* which is exceedingly abundant every year, the larvæ causing

---

[*] Bull. des Séances de la Soc. Roy. et Cent. d'Agric., vol. v. pl. 6, f. 4.

[†] Curtis's Guide, Genus 571.

[‡] Hymenop. Ichn. Affin. Mon., vol. ii. p. 333.

[§] Journal of Royal Agric. Soc., vol. v. p. 225, pl. J. figs. 46 and 47, the pupa, I expect, of a *Proctotrupes.*

[‖] Vol. vi. p. 36, *Proctotrupes Viator.*

much mischief in gardens; and at the close of the year 1845 many of them were sent to me as abounding on decayed portions of planted potatoes, and I have met with them likewise about the tubers and in flower-pots, where they burrow in all directions. Some I received in July were about ¼ of an inch long, of an ochreous brown or snuff-colour, and shagreened: the back is slightly convex, with 12 well-defined wrinkled segments and a horny shining head, much narrower than the body, intensely black or inclining to chestnut-colour, and slightly hairy; there are 8 distinct spiracles on each side, the penultimate segment is rounded, with 4 teeth on the margin, and the anal one has 4 smaller teeth, with 2 large spiracles near the base: it has no feet.

They were transformed to pupæ in the earth the beginning of August, and were then yellowish-white; the thoracic portion was very thick, with 2 horns in front; the body slender and subcylindric, the segments very distinct, with spiracles down the sides, and the tail spiny.

The flies hatched on the 21st of August, but they abound in fields, hedges, especially under trees, and even in the highways around London, the whole of that month; and there must be two broods of them, as they are found likewise in May. They belong to the FAMILY TIPULIDÆ, and to the GENUS DILOPHUS. The species was named *febrilis* by Linnæus, from the generally received opinion in Sweden of these flies resorting to houses where intermittent fevers existed.

39. D. febrilis is intensely black, shining, and hairy. The head of the *Male* is hemispheric, and covered with large densely pubescent eyes of a reddish-brown colour; there are 3 minute ocelli forming an elevated triangle near the base: the lip is broad, and the feelers incurved: the trunk is oval and gibbose, with 2 transverse rows of minute teeth before: the scutel is short and broad: abdomen sublinear, 8-jointed, the apex clubbed: the 2 wings are incumbent in repose, perfectly transparent and white but iridescent, the pinion only is slightly tinged with brown, the costal nervures pitchy, the others very faintly marked; a radial nervure uniting with the costa at the middle forms a brown spot at the extremity: 2 balancers, with a large compressed brown club: it has 6 long legs; anterior thighs the thickest, the shanks very short, the apex surrounded by a coronet of teeth; there are also several short spines outside; feet slender, 5-jointed, terminated by claws and suckers: length 2½ lines, expanse 5 lines. The *Female* is larger and very different, the head being much less, with small oval eyes not meeting on the crown: the abdomen is brownish and elongated, ovate at the extremity but narrowed at the base, and the tip is furnished with 2 minute tubercles: the wings are much longer and very ample, entirely brown, the

pinion being the darkest, with a brown stigmatic spot; all the nervures are pitchy; the anterior thighs are incrassated.

These insects fly heavily, their hinder legs hanging down, and in the evening they become sluggish, resting on herbage and bushes. The larvæ also inhabit cow-dung and horse-muck: it is therefore very possible they may be introduced into potato-grounds with the manure, or the flies may be attracted to highly manured ground to deposit their eggs; for so little is known of the economy of many insects, that it is impossible to determine their exact habits: indeed no description or figures were to be found of the larvæ and pupæ of this fly, until I sent them to the 'Gardeners' Chronicle.'*

FALSE SCORPIONS.

These singular little creatures have occurred in some numbers amongst decaying potatoes, where probably they live upon the mites, as one species is known to be very serviceable in keeping under those pests in cabinets of natural history; others are found attached to the legs of house-flies so firmly that it is scarcely possible to remove them, but whether they destroy the fly or only avail themselves of their power of flight to be carried from one locality to another is not known. These false Scorpions belong to an ORDER called by Latreille TRACHEARIÆ, to the FAMILY CHELIFERIDÆ, and the GENUS CHELIFER. I can find no description which answers to this species correctly: it is undoubtedly closely allied to Hermann's *C. nepoides*, but the inequality in the length of the legs seems to distinguish them, and for that reason I shall call the potato species

40. C. inæqualis. It is ¾ of a line long, of a lively rust-colour: the head is pointed; the two little eyes are scarcely visible; the feelers are like the claws of a crab, as long as the body, smooth, with scattered hairs, and 4-jointed; the basal joint is short, hatchet-shaped, 2nd twice as long and oblong, 3rd as large, pear-shaped, 4th the largest, oval, terminated by two long slender claws, forming pincers: thorax oval, with a transverse suture across the middle: body oval, and brown with scattered hairs, furnished with 8 shortish, ochreous, shining legs; 4 first the shortest, 5-jointed, and terminated by a minute double black claw (fig. 62; c, the natural size).

WORMS.

It may be remembered that in discussing the minute animals which affect the wheat-crops, a very remarkable little worm called *Vibrio tritici* was described and figured,† and its history was also

---

* Vol. iv. p. 868, with figures of the male, female, larva, and pupa.

† Journal of Royal Agric. Soc., vol. vi. p. 513, pl. O. figs. 27 and 28.

detailed. It appears that M. Rayer has discovered a similar species which breeds in multitudes in rotten potatoes; and the same animals were observed by Mr. Graham and myself last March, in myriads in the putrescent tubers. This Vibrio is named by Guérin, *Rhabditis tuberculorum*, and is shorter and stouter in its young state: the tail of the male is rounded; conical and pointed in the female: the mouth is furnished with 2 rounded nipples, and a 3rd between them connected with the œsophagus, and the body is devoid of articulations (fig. 63, magnified): it is not thicker than the finest hair, and scarcely visible in repose. As it is well figured, with dissections, in the Bulletin so often referred to in this Report, it is unnecessary to comment further upon this worm at present.

I am not aware that snails injure the potato-crops at any period, but slugs do much mischief to the late crops, enlarging the holes perforated by wireworms, snake millipedes, and other subterranean animals, which is one good reason for lifting the crop as soon as the tubers are ripe, to prevent unnecessary waste. This reminds me of a singular fact recorded in a useful monthly publication called the 'Farmers' Herald.'* A bag was found in a cooked potato, containing 11 white globular pellucid eggs, scarcely so large as mustard-seeds: they were a little pointed at one end, and had every appearance of having been laid in the cavity by a slug, which is exceedingly probable, as I have found them half concealed in potatoes, where they had feasted so long and increased so greatly in bulk, that it was impossible to withdraw them without enlarging the orifice.

I believe this may close my observations regarding the insects and small animals which directly or indirectly injure the potato-crops. They amount to 60 or more, but probably their name would be 'Legion' if we were thoroughly acquainted with all the species, in their different stages of development, preying upon this useful esculent; and although in the foregoing pages no attempt has been made to give undue importance to their agency, there can be no question that insects often injure the potato-crops to a great amount. Indeed, as we have endeavoured to show in these Essays, their mission is to labour in the destruction of vegetable and animal matter, and consequently there is not a crop in the field and garden that, sooner or later, is not subject to their ravages.

A Summary of the present Essay.

Aphis of potato, the same as that on the turnip, named *A. Rapæ*, and identical with *A. vastator*.

Various species of *Aphides* are found upon potato-haulm, as

---

* Vol. iii. p. 139.

Aphis Rapæ, A. Humili, A. Persicæ, A. Fabæ, and *Schizoneura lanigera.*

It is only when the *plant-lice* take possession of a *plant,* breed upon and *smother* it, that they can *affect its life.*

It is by *suction* they exhaust vegetation.

Lady-birds and their *larvæ,* the *maggots* of *dipterous flies,* and some small *bugs, live upon* the *plant-lice.*

A fly called *Sapromyza obsoleta* supposed to cause the *potato-rot,* laying its eggs in the young shoots.

Thrips minutissima accused of causing the *potato epidemic.*

They live by *suction,* and *never* are in *sufficient numbers* upon the potato-leaves to *affect the tubers.*

A minute ground-flea, *Smynthurus Solani,* feeds on the pulp of the leaves.

A *Smynthurus* in Nova Scotia *destroys* the very young *turnips and cabbages.*

They generate upon *old cultivated ground,* and damp drives them away.

Salt or *sea-weeds* scattered over the ground will *expel them.*

A *Podura* feeds on the pulp of the leaves, and is supposed to *poison the sap.*

Plant-bugs believed to cause the *potato-disease.*

Lygus Solani. L. contaminatus. L. bipunctatus, L. umbellatarum, Phytocoris pabulinus, and *P. viridis,* were the accused species.

Another species appeared 10 years earlier in the *United States,* where similar opinions were entertained of their *poisoning the potatoes.*

Frog-flies, called *Eupteryx Solani* and *E. picta,* breeding on the potato-haulm, and accused of destroying the potato-crops.

They live by suction, as well as the *plant-bugs,* from the time they are hatched to their final state.

Macrocnema exoleta, a leaping beetle, feeds upon and riddles the leaves of the potato and bitter-sweet.

Caterpillars of the *death's-head sphinx* feed upon *potato-leaves.*

This *moth robs bee-hives,* and is called also the *bee-tiger.*

An Ichneumon fly, *Trogus atropos,* lives in the *caterpillars* of the *death's-head moth.*

A mite, *Oribates castaneus,* congregates on the *dead potato-haulm* to feed on *fungi.*

M. Guérin attributes the *potato-disease* to *atmospheric changes,* and *not to insects.*

Surface-grubs, the caterpillars of moths, *Agrotis exclamationis* and *A. segetum,* destroy potato as well as turnip crops.

Maggots of Tipulæ, the *crane-flies* or *daddy-longlegs,* seriously affect the *potato-crops.*

They revel in *damp and undisturbed land: draining* is therefore *obnoxious* to the *Tipulæ maggots.*

The eggs are scattered among the grass and weeds.

The *larvæ* of *Tipula oleracea* and *T. paludosa* are living *from April to August,* and destroy turnip, potato, beet, carrot, and cabbage, as well as corn crops, and injure pastures and garden plants.

These *gnats* are most abundant *from July to November.*

Wheat cannot be grown after *clover-leas,* owing to the *maggots* of the *Tipulæ* and the *wireworms.*

Repeated *rollings* with Crosskill's clod-crusher, or *breast-ploughing* the turf and *burning* it, are the best *remedies* against the maggots.

Larvæ of *Tipula maculosa* injurious to *corn and potato crops* on *light lands,* and very destructive in *gardens* in the spring and summer.

These *gnats* abound in *May and June,* when the *eggs* are *laid.*

Watering with *salt or nitrate of soda* would free the land, as well as *searching* round sickly and dying plants *early in the morning.*

Repeated dustings of *soot, sea-sand,* and *salt,* would probably *destroy* the *maggots.*

Rolling grass at the proper season will *destroy* the *gnats,* and prevent the deposition of eggs.

Clover-stubbles should be kept *close fed* by sheep, &c., as it is an excellent *remedy.*

Rooks, starlings, sea-gulls, lapwings, snipes, and *pheasants,* consume immense quantities of *subterranean larvæ* or grubs.

Wireworms drill potatoes in the summer and autumn, if not earlier.

Potatoes when left in the ground *attract* all the *wireworms,* as will sliced potatoes when covered with earth.

Oat crop saved by sowing *soot* and *guano.*

A different species of *wireworm destroys* both *sound* and *diseased potatoes* in France.

Snake millipedes assist in *destroying potato-crops* on the first appearance of disease.

Iulus pulchellus is the most *abundant* and *mischievous.*

Centipedes in abundance in *potato-grounds,* especially *Lithobius forcipatus* and *Geophilus electricus?*

They are said to be *carnivorous,* and *G. electricus* leaves a *train of light* as it walks.

Podura plumbea? in abundance about *rotting potatoes* in February.

A *Tick,* and 3 mites, named *Acarus coleoptratus? Glyciphagus fecularum,* and *Tyroglyphus feculæ,* inhabit the *decaying tubers.*

A mite named *Acarus farinæ* also swarms in the spring in *diseased potatoes.*

They *love damp*, and a small degree of *heat* will *kill them.*

Three or 4 different *larvæ*, the produce of little *Rove-beetles*, &c., which probably feed on the mites, are generated *in decomposing potatoes.*

A Rove-beetle, called *Oxytelus nitidulus,* is a constant inhabitant of *decomposing vegetables.*

Nests of little beetles, *Abræus minutus,* in *rotting potatoes.*

Trichopteryx rugulosa, one of the minutest of beetles, also resides *in diseased potatoes.*

A little gnat, *Psychoda nervosa,* bred in multitudes from *rotten potatoes* in the *spring.*

The swarthy flies, *Sciara fucata*, *S. quinquelineata*, and *S. pulicaria?* hatched in multitudes from the same *tubers* which supplied food for their *maggots.*

Scathopse punctata? another small fly, was bred with them.

48 examples of a large fly, *Musca stabulans,* were bred from a single potato in August, and

58 of another fly, *Anthomyia tuberosa*, from the same rotting tuber.

These and a closely allied species are produced from *maggots* which are occasionally *voided* in vast quantities from the *stomach* and *intestines of man.*

Are they not *introduced* into the *stomach* with *badly* or partially *cooked vegetables?*

Drosophila cellaris, the Cellar-fly, also came forth from the *same potato* as the last-named flies.

Limosina geniculata is another fly I have hatched from *putrid potatoes* and *L. Payenii* also in France.

A *parasitic* fly, *Paramesius brachialis,* is often bred where the foregoing *flies* are *generated.*

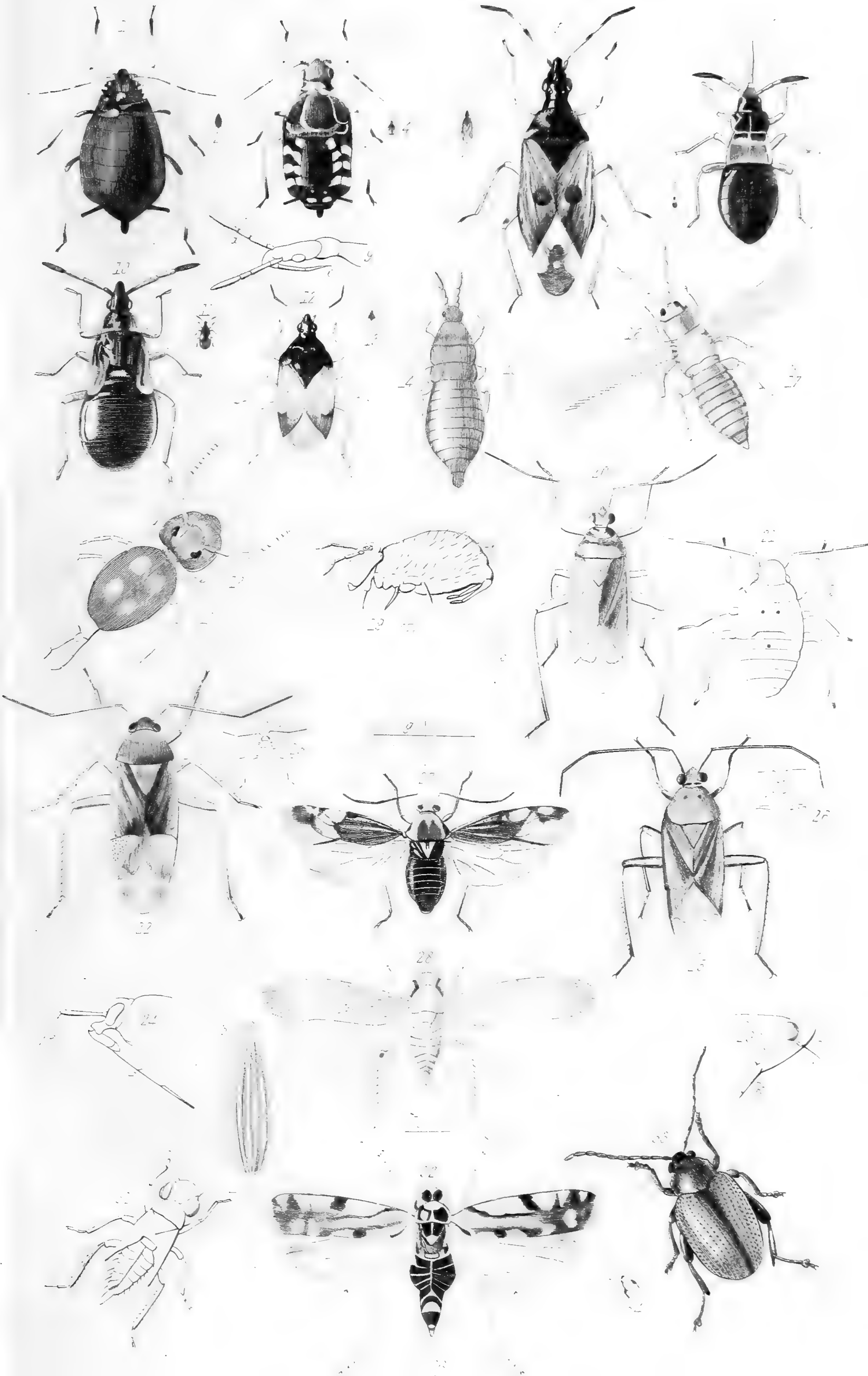
Larvæ of a fly, *Dilophus febrilis,* also infests the *tubers* in the ground.

Chelifer inæqualis, a false-scorpion, also resorts to *decaying potatoes,* probably to *feed upon the mites.*

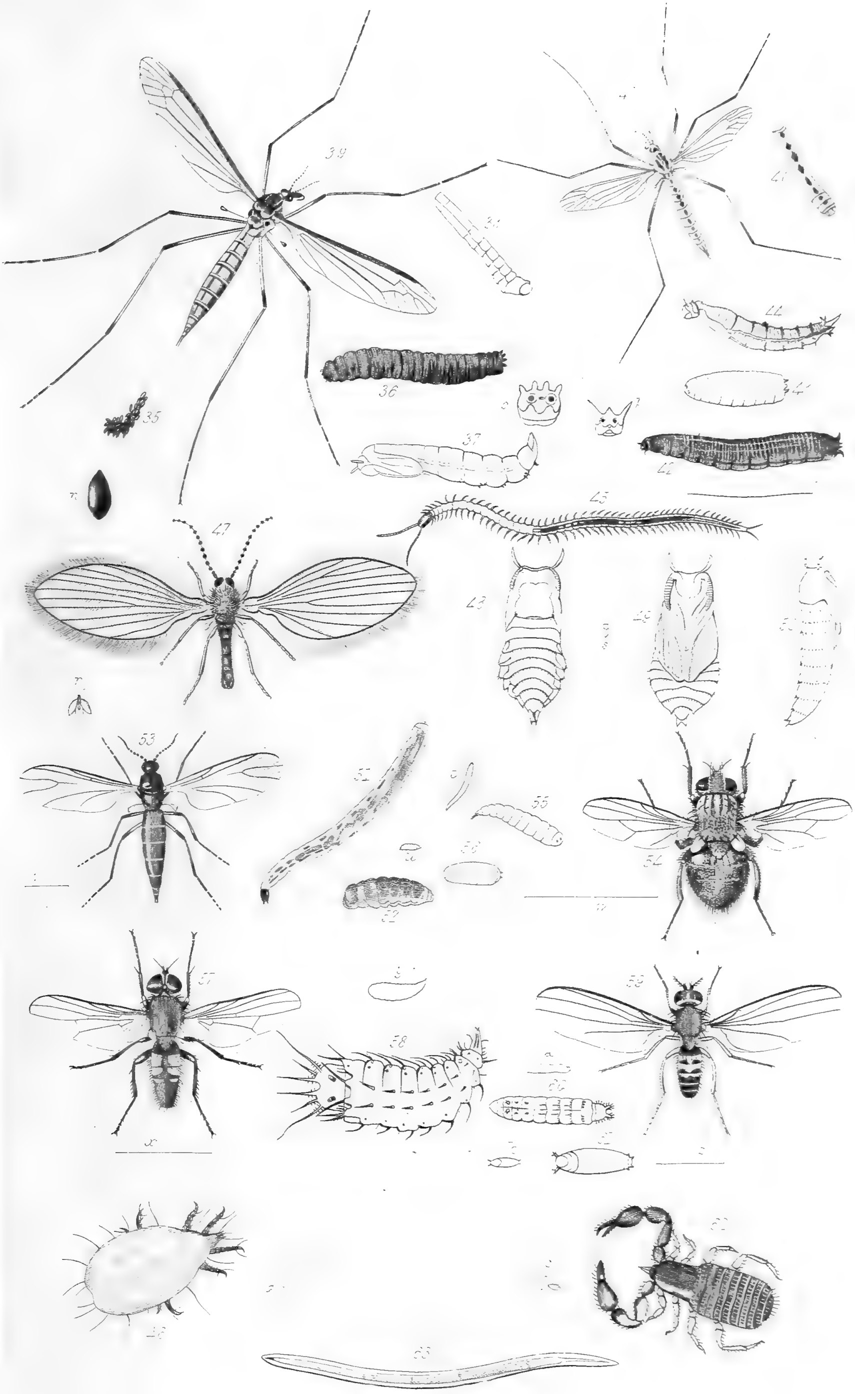
A worm, called *Vibrio* or *Rhabditis tuberculorum,* is generated in vast numbers in *putrifying potato-heaps.*

EXPLANATION OF PLATE U.

Fig. 1.* *Aphis Fabæ*, female.
Fig. 2. The natural size.
Fig. 3.* Pupa of *Aphis Fabæ.*
Fig. 4. The natural size.
Fig. 5.* *Hylophila Nemorum.*
Fig. 6. The natural size.



10
12
9
22
27
26
28
24
32


39
41
34
44
36
35
c
b
44'
37
42
n
45
47
43
49
50
r
53
51
55
56
52
54
57
58
59
66
62
63

V

Fig. 7.* The larva state of *Hylophila.*
Fig. 8. The natural size.
Fig. 9. The head and thorax in profile.
    a. The antennæ or horns.
    b. The rostrum or beak.
Fig. 10.* Pupa of *Hylophila Nemorum.*
Fig. 11. The natural size.
Fig. 12.* *Hylophila minuta.*
Fig. 13. The natural size.
Fig. 14.* Larva state of *Thrips minutissima.*
Fig. 15. The natural size.
Fig. 16.* *Thrips minutissima* flying.
Fig. 17. The natural size.
Fig. 18.* *Smynthurus Solani*, the potato ground-flea; its natural size is that of a grain of sand.
Fig. 19.* A *Smynthurus* in profile, to show its leaping apparatus.
Fig. 20.* *Lygus Solani;* the potato-bug.
    c. The natural length.
Fig. 21.* Pupa of the same.
    d. The natural length.
Fig. 22.* *Lygus contaminatus.*
Fig. 23. The natural size.
Fig. 24.* The head in profile.
    e. Base of the antennæ.
    f. The rostrum.
Fig. 25.* *Lygus bipunctatus.*
Fig. 26. The natural size.
Fig. 27.* *Lygus umbellatarum.*
    g. The natural dimensions.
Fig. 28.* *Eupteryx Solani*, the potato frog-fly.
    h. The natural dimensions.
Fig. 29.* The head in profile.
    i. The antenna.
    k. The rostrum.
Fig. 30.* The egg.
    l. The natural size.
Fig. 31.* The pupa state.
Fig. 32.* *Eupteryx picta.*
    m. The natural dimensions.
Fig. 33.* *Altica* or *Macrocnema exoleta;* the potato flea-beetle.
Fig. 34. The natural size.

EXPLANATION OF PLATE V.

Fig. 35. Eggs of *Tipula Oleracea.*
    *n.** One magnified.
Fig. 36. The larva or maggot from the same.
    *o.** Tail or stern, viewed in front.
Fig. 37. The pupa state of the same.
Fig. 38. Abdomen of the male fly, in profile.

Fig. 39. Female *Tipula Oleracea*, or crane-fly.
Fig. 40. Abdomen of the male of *Tipula maculosa.*
Fig. 41. Female *Tipula maculosa.*
Fig. 42. Larva or maggot of the same.
Fig. 43. The same contracted.
  *p.** The tail or stern, viewed in front.
Fig. 44. The pupa state of the same.
Fig. 45. *Geophilus electricus* (?), or *Anthronomalus longicornis.*
Fig. 46.* *Acarus* or *Tyroglyphus farinæ:* the flour-mite.
  q. The natural size.
Fig. 47.* *Psychoda nervosa.*
  r. The natural dimensions.
Fig. 48.* Pupa, view of the back.
Fig. 49.* Ditto, ditto, the underside.
Fig. 50.* Ditto, ditto, nearly in profile and attenuated.
  s. The natural size.
Fig. 51.* Larva or maggot of *Sciara quinquelineata.*
  t. The natural size.
Fig. 52.* Pupa of the same.
  u. The natural size.
Fig. 53.* *Sciara* (or *Molobrus*) *quinquelineata.*
  v. The natural dimensions.
Fig. 54.* *Musca stabulans.*
  w. The natural dimensions.
Fig. 55. The larva or maggot of the same.
Fig. 56. The pupa.
Fig. 57.* *Anthomyia* (or *Homalomyia*) *tuberosa.*
  x. The natural dimensions.
Fig. 58.* Larva of the same.
  y. The natural size.
Fig. 59.* *Drosophila cellaris*, the cellar-fly.
  z. The natural dimensions.
Fig. 60.* The larva or maggot of the same.
  a. The natural size.
Fig. 61.* Pupa of the same.
  b. The natural size.
Fig. 62.* *Chelifer inæqualis*, a false-scorpion.
  c. The natural size.
Fig. 63.* *Vibrio* (or *Rhabditis*) *tuberculorum*, greatly magnified.

Obs.—Those numbers with a * attached, refer to the objects which are represented larger than life, and all the figures are drawn from nature, excepting No. 63, which is copied from M. Guérin's plate.

Hayes, near Uxbridge, February, 1849.

V.—*On the Stoppage of Drains by a Stony Deposit.*

From Lord Portman.

To Mr. Pusey.

Dear Pusey,—I wish to call the attention of those persons who are engaged in draining land, to the accompanying statement of facts tending to show the importance of ascertaining the quality of the water which is to pass through the drains, before selecting the material of which they are to be formed. I have seen many cases where drains built with stones—made with broken stones—filled with boughs of trees or with poles of alder or larch—made with tiles and soles (as each person has thought best), have been stopped, adjacent to turf-wedge drains made from 20 to 40 years before, which were running perfectly. I have in some cases satisfied myself that a deposit has attached itself to these materials, and has more or less impeded the drainage, and that no deposit has been made in the turf-drains by the same water; but I have not hitherto ascertained with sufficient accuracy the real cause of the stoppage, though I have little doubt, from what I now know, that a chemical analysis of the water would explain it. In tile-pipes I have not yet seen any similar stoppage, but my experience of pipes is not yet sufficient to justify me in saying that they would not be liable to similar obstructions. I believe that the aid of the chemist and of the geologist are essential to the permanent success of the drainer. I now give you one case in full detail, sent to me, at my request, by my friend Mr. Goodden of Compton House, near Sherborne, from whom I received the water and the deposit, whereof I send you a copy of the analysis made by Professor Way.

Yours truly,

Bryanston, April 28, 1849. Portman.

"Although I have been doing a great deal of draining of late, I have been a good deal staggered as to its being an improvement of long continuance. Twenty years ago a large pasture field of mine was drained under the old and exploded system of Turf-draining. There is a carrier of stone of large dimensions in the field; this was choked some weeks since, and I had it opened a long distance up, and, to my surprise, I found the whole drain *completely closed* with the *incrustation* from the water; the substance is precisely the same as that we find in our boilers. The field in question is 29 acres of old pasture; the soil of which is a loam with a clay subsoil. It was drained in the year 1829, it being then in a wet state. The drainage was effected partly by what is called turf or wedge-draining, and partly by stone. There was a stone drain straight down the field, into which some of the side drains emptied themselves; it was a good sized drain, capable of carrying a large body of water. The expense of draining this field, being chiefly labour, was 50*l.* From being quite in a wet state, it soon became dry; the drainage appeared completely successful, and so it remained until the winter of 1848. At this time the field appeared again wet; but in the neighbourhood of the stone carrier particularly so. In January of this year, 1849, on walking over this piece of land, I found it looking generally bad, the soil was spongy, the herbage looked unhealthy, and some places presented all the appearance of an incipient bog. I have no hesitation in saying that this field was in a much worse condition than it was before it was drained. I therefore determined to open the stone carrier, which was done on the 13th of January. We found the drain completely choked with a deposit from the water. The substance is hard, and in some places the stones of the drain were so bound together with incrustation, that it required the pickaxe to divide them. When the drain was first opened, the water poured down it in large quantities; it has been opened nearly a month, and the stream could now easily be carried by a 1¼ inch pipe. I am happy to say the land presents a very different appearance, and is nearly dry. With regard to the drainage of this field, there can be no doubt that it was very imperfect. But still the stoppage of the stone drain with a deposit from the water has caused me to doubt whether draining, in some localities, is a substantial improvement of long duration. Where the water is what is called 'hard' and liable to form a deposit, the same thing may happen in pipes as has occurred in my stone drain.

"You ask, How have the turf-drains answered in my field, which was drained 20 years ago?

"I have had some opened and particularly examined, and I find, with scarcely any exception, that the water in them runs very well. The deteriorated state of the field seems to have arisen from the stoppage of the stone carrier, because, as many of the turf-drains led into this stone carrier, the drainage of some acres was necessarily stopped. The stone drain is still open, and the side turf-drains run freely into this opened carrier. I am rather disposed to think that the deposit in the drain must be formed, in some measure, of earthy matter petrified by the water; the carrier drain had no stone bottom, so that probably uneven surfaces were formed, and thus from time to time earthy deposits may have formed.

"I send you a bottle of the water and a lump of the deposit, of which I hope you will obtain an analysis. The drainage question is one of great importance to us. Of this I feel satisfied that a great deal of money is sunk in draining, and unless it is done well, that is, on scientific principles, we might as well not drain our land at all.

"J. GOODDEN."

From Mr. Way.

"I send you the analysis of the water and the deposit: you will readily observe that the composition of the water sufficiently accounts for the deposit, which indeed it closely resembles in character. The quantity of carbonate of lime in the water is not however excessive, and it must require some time to form so large an accumulation. From the analysis it is quite clear that the drains are stopped, not mechanically, but by a chemical precipitate; this is evident by simple inspection of the substance: the deposit is principally carbonate of lime, and I believe the phenomena you mention may be referable to the following causes: the stone drain would probably for the most part be only partly filled with water, and would leave opportunity for the escape of the carbonic acid, by which the carbonate of lime is held in solution; the result being a crystalline deposit of this substance, which in time would choke the drain. I must add that the stone acts like a piece of bread in a glass of champagne, in affording points for the escape of the gas.

"In the turf-drains, on the other hand, there would most likely be a gradual evolution of this gas from decomposition of vegetable matter, and the water, remaining fully charged with carbonic acid, would not afford a deposit, or, if at all, in smaller amount. From the small size of turf or wedge-drains, I can quite understand that they would not be filled up, because they must contain less air for the carbonic acid to escape into, and fewer points of escape for it even were other circumstances favourable.

"Analysis of a deposit taken from a stone drain:—

"Carbonate of lime	86·38
Sulphate of lime	2·52
Magnesia, common salt	traces.
Insoluble matter, sand, clay, &c.	10·22
	99·12

"N.B.—The sand and clay are deposited mechanically in thin layers, obvious to the eye, between the thicknesses of carbonate of lime.

"Analysis of the water passing through the drains:—

"Solid matter in a pint of the water 3·160 grains, consisting of—

"Carbonate of lime	2·123
Sulphate of lime	0·270
Magnesia	0·058
Common salt	0·216
Silica	0·338
Vegetable matter	0·154
	3·160"

"T. Thomas Way."

VI.—*On the Farming of South Wales.* By CLARE SEWELL READ.

PRIZE REPORT.

IN attempting a report on the farming of South Wales, the writer is fully sensible of the importance and difficulty of the task which he has undertaken and his incompetency to do justice to his subject. He trusts, however, that his effort will not be deemed presumptuous, but that he may have credit for the feeling which really actuates him, namely, a desire to give some account of, and to draw attention to, a district in which he lives, and in the cultivation of which he takes the deepest interest, with the hope that art may be brought to bear on that fair country which nature has so lavishly endowed, but which the hand of man has hitherto comparatively neglected.

The requirements of the Royal Agricultural Society are fourfold:—

1st. The character of the soils.
2nd. The peculiarity of the agricultural management.
3rd. The improvements since the report of Walter Davies in 1814.
4th. The improvements still required.

It is scarcely possible within reasonable limits to describe the various soils of a country comprising six counties, whose area is 4000 square miles, and above 2,530,000 statute acres; or, to portray the peculiarities of its management, where all recognized system of farming is wanting, and the peculiarities are nearly as numerous as the parishes; or to point out the improvements still required where almost everything which science and capital have effected for the sister country is still undone.

But it will not be so difficult to deal with the "improvements which have taken place since 1814." Here, alas! the task is easy.

It is proposed therefore, to enter, but not minutely, upon the character of the various soils, and to give the result of the writer's experience, observation, and information, in a general outline of the agricultural management of South Wales, after which the improvements that have been made and those still required will be touched upon.

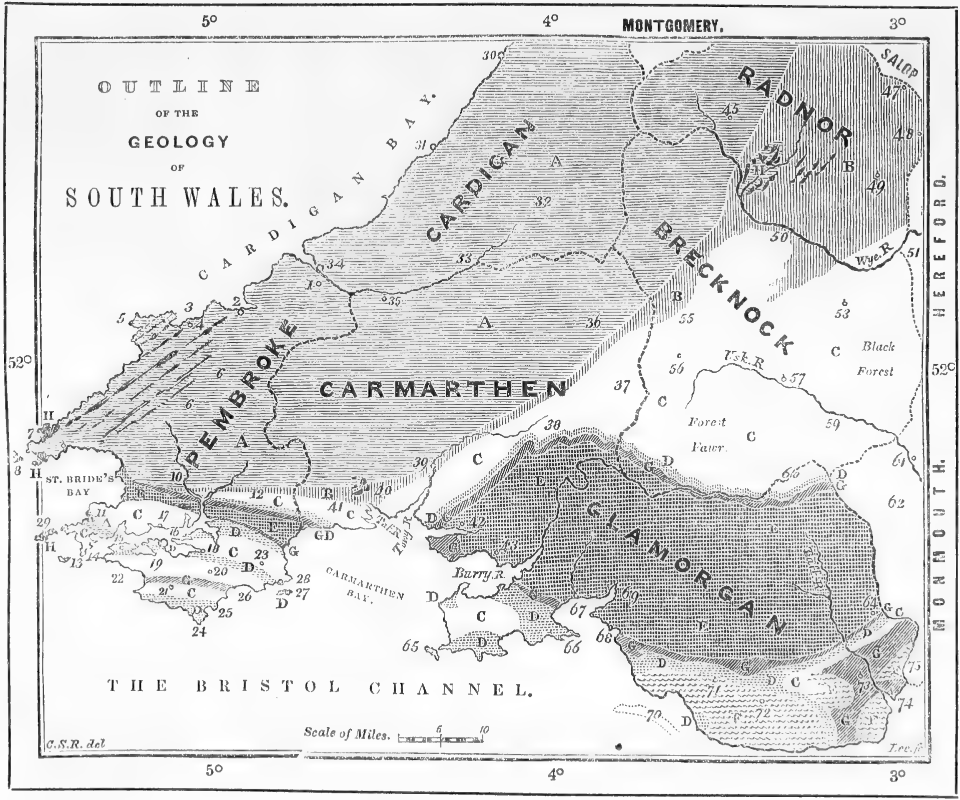
South Wales now comprises the maritime counties of Pembroke, Cardigan, Carmarthen, and Glamorgan, and the inland counties of Brecknock and Radnor, containing, according to Mr. Cary's communications to the Board of Agriculture, 2,530,360 statute acres. The population in 1841, the date of the last returns, was 515,067, being an increase of 186,000 since

ARRANGEMENT OF THE STRATA.

A. Upper Silurian.
B. Lower Silurian.
C. Old Red Sandstone.
D. Limestone.
E. Coal Measures or Fields.
F. Lias Shale.
G. Millstone Grit.
H. Trappean Rocks.

REFERENCES TO NUMBERS ON THE MAP.

1. Kilgaran.
2. Newport.
3. Fishguard Bay.
4. Fishguard.
5. Stumbles Head.
6. Prescelly Mountains.
7. St. David's.
8. Ramsey Island.
10. Haverford West.
11. St. Bride's.
12. Narbeth.
13. St. Ann's Head.
14. Milford Haven.
15. Angle.
16. Dockyard.
17. Milford.
18. Pembroke.
19. Rhoscrowther.
20. Orielton.
21. Castle Martin.
22. Freshwater West.
23. St. Florence.
24. St. Goven's Head.
25. Stackpole.
26. Freshwater East.
27. Caldy Island.
28. Tenby.



OUTLINE OF THE GEOLOGY OF SOUTH WALES.

NUMBERS ON THE MAP CONTINUED.

29. Skomer Island
30. Aberystwith.
31. Abaraeron.
32. Tregaron.
33. Lampeter.
34. Cardigan.
35 Newcastle-Emlyn.
36. Llandovery.
37. Llangadock.
38. Llandilofawr.
39. Carmarthen.
40. St. Clare.
41. Laugharne.
42. Kidwelly.
43. Llanlly.
45. Rhayader.
47. Knighton.
48. Presteign.
49. Radnor.
50. Builth.
51. Hay.
53. Talgarth.
55. Mynydd Epynt.
56. Trecastle.
57. Brecon.
59. Crickhowel.
60. Merthyr Tydvil.
61. Abergavenny.
62. Pontypool.
64. Caerphilly.
65. Worms Head.
66. Mumbles.
67. Swansea.
68. Aberafon.
69. Neath.
70. Nash Sands.
71. Bridgend.
72. Cowbridge.
73. Llandaff.
74. Cardiff.
75. Newport

1811. North Wales, during the same period, on an area of 1,801,720, had given an increase of 118,000. Still the *agricultural population* is very low in proportion to any similar extent of area in England; this is doubtless to be attributed to the farming of South Wales being chiefly pastoral. In the purely agricultural county of Radnor the population to the acreage is as 1 to 10, whereas in the mineral county of Glamorgan the proportion is as 1 to 2½ acres.

Pembroke is divided into 7 hundreds and 145 parishes, and has 6 market towns. It contains about 345,600 statute acres: its population in 1841 was 88,262, exhibiting a regularly proportioned increase during the last thirty years. English is the prevalent language in a great part of this county. In the reign of Henry I. numerous Flemings settled themselves here; and it is said, by the Welsh historian, that the King placed among them some English settlers to teach them the English language and customs. The posterity of these settlers remain to this day in the southern parts of the county, where they are plainly distinguishable from the ancient British population by their language, manners, and customs. Owing to the geographical position of Pembroke, its extent of seacoast is double that of its land boundary: the surface is alternate hills and dales. The whole of Castle Martin Hundred, forming the southernmost part of the county, is distinguished for its gentle undulating horizontal surface.

Cardigan is divided into 5 hundreds and 64 parishes, and has 5 market towns. Its population in 1841 was 68,380: its area 377,600 statute acres.

Carmarthen is the largest county in South Wales, and is divided into 8 hundreds and 87 parishes, and has 8 market towns. Its population in 1841 was 106,482; its area 623,360 statute acres.

Glamorgan, the great seat of the iron trade, considerably more than doubled its population between the years 1811 and 1841; the numbers being in the former year 81,268, and in the latter 173,462. Its area is 422,400 statute acres. This county is divided into 10 hundreds and 118 parishes, and has 9 market towns.

Brecknock is divided into 6 hundreds and 61 parishes, and has 4 market towns. Its population in 1841 was 53,295; its area 512,000 statute acres. Considerable attention has for a long period been bestowed on the breed of horses in this county.

Radnor is divided into 6 hundreds and 52 parishes, and has 4 market towns. Its population in 1841 was 25,186, being an increase of only 3387 since 1811: its area 249,600 statute acres. The surface of the county is throughout hilly. The original Welsh ponies are still bred in the mountains. This county contains a greater number of mineral springs than all the others of South Wales conjointly.

The principal characteristic of the *climate* of South Wales is its great *humidity*. As compared with Central England, the cold is not usually so severe, nor the heat so great. The spring is long and backward, and there is an old Welsh adage, "Summer till January, and winter till mid-June." At irregular intervals, but for fully two-thirds of the year, westerly winds prevail. The changes of the atmosphere are extremely sudden and perplexing. The high mountains of the interior convert the invisible vapours from the Atlantic into sensible vapour or clouds, whence misty rains frequently descend, and sometimes unexpected heavy showers; still the inhabitants can foretell that rain is close at hand, when there appears every prospect of a fine day. They principally ground their observations on the noise of the sea, the roar of a waterfall, the sound of bells, shape of mists and clouds resting on the mountains. During the summer and early autumn heavy dews are of frequent occurrence, and warm close mists will last for several days: these sometimes considerably impede hay and corn harvests, and consequently the saving of grain in good condition cannot be calculated upon with the same certainty as in England. On the other hand South Wales is, above all others, the country for grass and green crops, as the moisture and dews of summer, and the gentle variation of heat, must exert most beneficial influence on all such vegetation, especially the young turnips. All along the coast, and indeed far inland, the gales from the west are particularly severe, and frequently do much damage to the growing crops. Of course the temperature varies with the aspect and altitude of the district. In the alpine tracts, the Rev. Walter Davies observes, "rain in lower places is here sleet; sleet, snow; and storms, tempests." Meteorological observations prove that the depth of rain is not so much as in some counties of England, therefore the humidity of the climate arises from constant mists rather than heavy rains. The common opinion of the hazy weather prevailing in South Wales has been thus expressed:—

> "Winter, mists will fall in snow;
> In spring the winds will coldly blow.
> Summer fogs foretel much heat;
> Autumn mists will rain repeat."

As might be supposed by merely glancing at the geographical situations of some districts, there are great varieties of climate. Thus the temperature and humidity of the Vales of the Teify and the Towy are quite different from those of the Wye and the Usk. The former open their mouths at the south-west to receive the accumulated mists of the Atlantic, while the lofty mountains arrest the vapours before they reach the latter, which, being open to the east, have a climate similar to, and as cold as, that of the Midland Counties of England. Again, while Pembroke and Cardigan are prominently exposed to the violence of the westerly gales, Glamorgan is partly surrounded by rising ground, and protected in some degree, even to the south, by the counties of Somerset and Devon.

The north-western portion of South Wales rests upon the clay-slate formation, or as they are geologically termed, the upper and lower Silurian deposits. These formations commence at the north portion of St. Bride's Bay, running nearly in a horizontal line by Haverfordwest and Narberth to Laugharne. They proceed by a north-east course to the south of Carmarthen and Llandovery; then, before reaching the borders of Radnor, make a curve in a contrary direction, and again bending upwards pass into Hereford, a little above Hay. This large tract, covering more than 2500 square miles, includes the northern and larger part of Pembroke, the whole of the county of Cardigan, nearly all Radnor, and a very considerable portion of Carmarthen. In the neighbourhood of St. David's, Fishguard, St. Clare's, and Radnor, the trappean rocks frequently occur. In some instances the soil of the clay-slate formations is tolerably productive, in others quite the contrary. These formations occupy many elevated and exposed situations in the district, and often will not *there* pay for arable cultivation. The soil is generally good upon the *grey shale,* but unproductive when resting on a *blue slate.* The valleys and sides of the mountains abound with peat, and clay is in many places within a few inches of the surface. The south sides of the hills, when not too steep, often produce better corn than the hollows below. Most of these soils are deficient in calcareous matter, and the great distance from lime renders improvement in many parts expensive and slow. When the soil is ploughed in the upper districts, oats and (till lately) potatoes were the only crops successfully produced: but on the low lands good corn is grown, and there can be no doubt that nearly all the soil is favourable for the cultivation of turnips. The best land of Radnor is found in the valleys, through which the Wye, the Lug, and the Teme flow. In these tracts turnips are grown to a considerable extent, being drilled on ridges. The meadows about Upper Radnor are wet and barren, but the hills afford good sheep-walk. The northern portion of the Brecknock which rests on these formations is cold and unproductive. In Cardigan several rich loams are to be met with in the valley of Teify and Aeron. The Vale of Towy, in Carmarthen, has a rich fertile soil, and on the level of the Taf from the borders of Pembroke to Laugharne, the ground produces luxuriant crops. By the sea-coast of Pembroke and Cardigan there is a large extent of table-land, which is of better and lighter quality than the irregular ground of the interior. This tract which has long been celebrated for its barley, generally abounds with large porous grey field-stones. These also cover the pastures, and are not removed, as in seasons of drought they retain considerable quantities of moisture. The trap-rocks, in districts where they appear, produce important changes in the nature of the soil. When not too hard or too much elevated they afford land which will readily produce all crops, but especially barley. There are anomalous detached rocks of limestone in the vicinity of Radnor which are very serviceable in that otherwise limeless tract. The chief mineral productions of the Silurian deposits are slates; but lead, and even silver are also found.

The whole of the county of Pembroke, south of a line drawn from Tenby to St. Bride's, is composed of alternate layers of the old red sandstone and carboniferous limestone. The fertile level of Laugharne rests upon the old red sandstone, which latter proceeds in a narrow strip south of the Silurian deposits, till it reaches Brecknock, where it takes a tortuous course towards the east, and runs into Monmouth south of Abergavenny. Its breadth here exceeds twenty miles. It again makes its appearance near Cardiff, and is distinctly visible, in conjunction with the limestone, in the promontory below Swansea. It will be thus seen that the old red sandstone occupies a very considerable portion of Brecknock, extending over nearly 400 square miles. A narrow belt of limestone and millstone-grit enclose, in an irregular circle, the whole of the extensive coal-measures of Glamorgan. These small veins commence at Kidwilly, pass north of Merthyr Tydvil, and extend nearly to Pontypool. They again enter Wales, about Caerphilly, and lose their distinctive form by mingling with the lias shale in the region of Bridgend and Cowbridge. In Pembroke the coal-fields form a strip of about 5 miles wide across the county south of the slate formation, and, with the Glamorgan tract, constitute an area of about 900 square miles. The red soils are variable, but, although there are many shallow and light tracts, generally speaking the land is kind, easily worked, and of superior quality. The principal valleys of the red sandstone extend on the banks of the Usk and the Wye. The former river flows only through this formation, and as it brings down with it no tenacious earthy matter, the soil of the valley is decidedly light, though kind and productive. By the good agriculture found there capital crops of grain and turnips are grown, yet the pastures suffer materially in seasons of drought: the Wye on the contrary rises in the Silurian deposits, and its clayey sediment improves the weakness of the red soil, which thus becomes able to produce heavy crops of all grain. The hilly tracts are grand and lofty, and contain the Brecknock Beacons, which attain an elevation of 2862 feet, and are consequently the highest mountains of South Wales. The pasturage of all this alpine district is much superior to the higher portions of the slate formations. Laugharne Marsh, which was originally enclosed from the sea, is celebrated for its goodness of soil and its luxuriant crops of wheat and beans. It is a beautiful sandy loam, with a substratum of rich clay. The limestone land is always dry and fertile when a moderate quantity of soil covers the rock; should there be much clayey earth upon the limestone, the soil is cold and poor; and if the rock is *too near* the surface, it is light and weak, but produces sweet herbage for sheep. A mixture of these last-mentioned formations by the red soil washing over the limestone produces a beautiful, tender, and fertile soil.

To illustrate the great variety of these soils, and to show the impossibility of describing them all, I will detail more minutely those that appear in the rich and comparatively level hundred of Castle Martin, in the south of Pembroke. First taking the district bounded on the north by Milford Haven, there is a long tract of the old red sandstone, which is for the most part shallow and light, yet quick, dry, and healthy land: this extends to the north of Angle and Pwllchrogan, and to the land in the vicinity of the Dockyard. Next there is a vein of limestone which appears at Pennar, runs from Greenhill, through Lower Hentland to Eastington; crosses Angle Bay, and proceeds through that parish to Pill, north of the Blockhouse, at the extreme point of the Haven. This formation is generally buried too deep to exercise any distinctive or beneficial influence on the soil. The limestone is impregnated with much magnesia, and therefore more prized for building than for agricultural purposes. A wider belt of limestone commences a little below Tenby, and runs through the fertile vale of St. Florence to Carew; whereas the country traversed from Pembroke to Tenby, and commonly called "The Ridgeway," rests upon the old red sandstone, and affords soils of various qualities. At Lydstep Haven another belt of limestone presents itself, and proceeds through the rich soils of Manorbier, Hodgeston, and Lamphey, to Pembroke and the north of Monkton. Again, in the elevated part of Manorbier by the sea, the red soil commences a larger district, running west to St. Daniel's, and forms a great portion of Monkton, Pwllchrogan, Rhoscrowther, and Angle. The soil thus comprised varies exceedingly. In Angle, though pretty good, it is much exposed to the sea and full of springs. Entering Rhoscrowther at Freshwater West, there are large accumulations of sea-sand, which form extensive "burrows." The soil of the greatly improved farms of Broomhill and Kilpaison from this cause presents a sandy loam of a weak description; whereas after passing Neath the farms in that portion of Pwllchrogan parish are clayey, wet, and unproductive. On coming to Monkton, Corston is good land and well cultivated, and by the south of Pembroke, passing Portclew, the land is of fair average quality. Altogether the red soil or rab is more retentive and argillaceous than that of Brecknock, but generally more infested with springs. The rab is best for grass, the limestone for corn. A narrow strip of millstone-grit commences at Freshwater East, and runs along the entire valley by Orielton to Freshwater West on the opposite side. This deposit is covered with a deep bed of strong tenacious clay, which is wet from surface-water and springs that rise above it. Once more the rab appears at Trewent, and, running to the north of Castle Martin, forms the upper boundary of the Stackpole estate. In Cheriton the land is capital, but the higher portions of St. Petrox, St. Twynels, and Warren are poor. To the north of the village of Castle Martin lies "The Corse," a tract of peaty morass resting on clay, which Mr. Davies mentions as being then recently enclosed by Act of Parliament. Although it paid well for cultivation, growing capital crops of wheat, oats, and gigantic coleseed, yet, since the death of the first lessee (who was presented with a gold medal by the Society of Arts for reclaiming this waste), it has been allowed to relapse pretty nearly into its primitive state. Nearer the sea are large tracts of sea-sand, growing principally the sea-sand sedge, useful only as sheep-walk or warren. The remaining portion of this promontory rests upon the carboniferous limestone and comprises some of the best land in the Principality. The plain, stretching from Stackpole to Brownslade, is fertile in the extreme. Nearer the South Cliffs are extensive downs, which produce short but sweet herbage for sheep, as the soil is very shallow, in many places the rock is hardly covered. The great drawback to this fine district is the scarcity of water. All this limestone when calcined is perfectly white, and is excellent manure, but not very strong cement. Mr. Davies, in his report, says, that the red soil of Pembroke is entirely distinct from that of Brecknock; "its position is reversed, its substratum different;" and he considers the "most striking instance of anomaly in the limestone is the intrusion of a red-soil tract upon a substratum of rab." The old red sandstone occupies quite half Castle Martin Hundred, the finest portions of Roose, with a little of Narberth, and as it is also prominent in Gower, geologists must decide whether it is altogether "an anomaly and an intrusion." The soil of the limestone is generally a dark marly loam, lighter, and inclined to be sandy in some districts: it produces well all grain and root crops, and is equally excellent for pasture, as the white clover (Trifolium repens) springs spontaneously. The limestone soil of Gower (the neck of land below Swansea) is identically the same as that to the south of Pembroke.

The soils which rest upon the coal measures and millstone-grit consist chiefly of clay, sand, and peat, which are usually distinguished by their extreme barrenness, and are often not considered worthy of cultivation. They occupy the highest ground of Glamorgan, a second-rate elevation in Carmarthen, but fall much lower in Pembroke. The land in the vicinity of Swansea, though naturally barren, is rendered still more sterile by the poisonous smoke of the numerous copper furnaces. A more desolate and unproductive country cannot be found than that part of the coal measures through which the road runs from Swansea to Carmarthen. In some favoured spots, by high farming and regular manuring, I have seen good returns of all kinds of grain and green crop. This is particularly the case near the iron works, where spirited wealthy men are desirous of improving the soil: it was found highly necessary to raise provender for the numerous horses employed, and also it pays better in tillage than in grass. The soil of the coal fields is often poisoned by acid underground water; but it is more easily improved than the poor lands of the slate tract, as the clays are less retentive, and lime is here close at hand. This stratum produces large quantities of iron, and the bituminous and anthracite coal.

The lias shale or lias limestone is better known by the common name of Aberthaw limestone. The lime when burnt is a buff colour, and celebrated for setting in water, and as a lasting cement. On the coast of Glamorgan the strata fell down, and the soft useless part being worn away by the action of the tides, the innumerable pebbles which are now used consist only of the nucleus portion of the stone. The blue and grey lias which occupy most of the Vale of Glamorgan, have soils of a strong dark loam resting in many instances on a tenacious clayey subsoil, naturally adapted for wheat, beans, and oats. The lighter portion—the bastard lias (which is a link between these strata and the limestone) is more kind for the production of barley and turnips. Large cattle are reared in the pastures, and many good sheep are fattened. The fertile tract by the river Ely, in addition to its own good soil is covered with large alluvial deposits of sandy loam, which are supposed to have been washed down from the hills of the coal measures.

On spots of the coasts of the Bristol Channel, but particularly below Laugharne, Kidwelly, and Aberafon, are large masses of sea-sand, which are used as sheep walk, and covered with the sea mat-weed or sedge (Arundo arenaria).

These are the principal geological divisions of the country. Most of the formations belong to very early deposits. Geology, though extremely useful, will not single-handed here faithfully describe the qualities of the soil, as aspect, climate, and elevation exert such decided influence.

The agriculture of South Wales may be considered as a mixture of "*breeding, dairying, and tillage.*" It is curious to see how the latter has increased, and to trace the various motives which have led to the more extensive culture of corn. Formerly when the home markets were very small, the production of grain was limited, and pasture land was never broken up, but with a view to its improvement. After three crops of corn, with two good manurings, it was again laid down to natural grass. But in the time of the war, a demand sprang up for corn in the English markets. This was the case when Mr. Davies made his report, and he observes, "Corn culture becoming a source of much greater profit than heretofore, violations of the old approved principles took place, and they were almost entirely abandoned." Since then the stupendous copper works and large iron mines, the numerous collieries, and the Dock-yard, have all increased the consumption and improved the demand. Instead of South Wales exporting corn to Bristol and Liverpool, she now receives large quantities from those and other parts. However, the agriculturists of the districts most accessible to good markets discovered that, in order to increase their produce, they must improve their farming and adopt better rotations; while those more remote exhibit a similar style of tillage to that practised years ago. Thus the south of Pembroke, the neighbourhood of Laugharne, and the great portion of the counties bordering on England, are farmed in a judicious and most superior manner. Indeed, many parts of Glamorgan produce such crops of wheat and turnips as could compete with any county in England. But to attempt to minutely relate the "peculiarities" of the many commendable systems pursued on the borders of South Wales, would only be to describe the various ramifications of Monmouth and Hereford farming. Even the traveller by the Swansea or Carmarthen mails cannot fail to notice how conspicuous and beneficial is the influence of English farming when first he enters Wales, and how gradually that superiority dies away. But it is the general farming of the district which must claim special attention, and I must now proceed to consider the rotation of crops usually found. As few of the leases of South Wales contain restrictive clauses, each farmer crops as he thinks best, and probably no two men in one parish pursue a precisely similar plan. Still in the west and central districts, after comparing the numerous variations that occur, the following will be found the common course of the country:—

Good Land.		Inferior Soils.	
1. Naked Fallow.	6. Clover.	1. Fallow.	6. Grass.
2. Wheat.	7. Grass.	2. Wheat.	7. Do.
3. Barley.	8. Do.	3. Barley.	8. Do.
4. Oats.	9. Do.	4. Oats.	9. Do.
5. Barley.	10. Do.	5. Clover.	10. Do.

It must not be imagined that in the interior of South Wales, there are not frequent beams of better agriculture. Many gentlemen farm largely and well, and perhaps some spirited tenant may follow his example. But their efforts and their improvements are confined to small localities, and are the exception, not the rule. The other isolated modes do not alter the principle of the system. Thus in some elevated tracts, oats succeed oats, or may be varied with a crop of potatoes, and at length the land (*when it will not double its seed*) is, with oats, laid down in grass, till the time arrives for its undergoing similar treatment. Again, in the barley districts, there is, 1 wheat; 2 barley; 3 peas; 4 barley: or 1 wheat; 2 barley; 3 barley; 4 barley: or 1 barley; 2 barley; 3 peas; 4 barley; and then laid down, generally for the same number of years as it has borne crops. In a wonderful district of Cardigan, barley (without other manure than sea-weed and sea-sand) has been grown for many years in succession. One field is mentioned as *having been cropped with barley for* 100 *years, without a single alteration.* In some parts of Carmarthen the campaign of cropping is opened with taking wheat on a limed and manured ley; but still the general practice of the country is the one before mentioned, to the further detail of which I now propose to return.

The ley field selected for *fallow* has furrows opened at the distance of 10 to 15 yards. The furrow slices are then carted into convenient heaps or "mixens," and there mixed with lime. Very often this is dispensed with, and the lime either set about the ley, or carted on the fallow during the summer. The land is ploughed during the winter months, and before the autumn it receives two more ploughings, and is well harrowed and rolled. It is generally imperfectly cleaned, as *no couch is burned or picked off.* Root weeds, too, are merely allowed to wither; but should the summer prove wet, they do not die. At some leisure period the farm-yard manure is carted to the field, and thrown on those mixens already mentioned. All is packed over, and about September it is set about the land, varying from 15 to 20 loads per acre. Three bushels of wheat are now sown broadcast, and the field drawn out into ridges three feet wide. Six furrows complete the ridge; but before the last is taken up, about half a bushel more seed is applied. Nothing further is done (with the exception sometimes of a little hand or spud weeding) till the time for cutting arrives. The ridges are of course nearly semicircular, and it is stated, that they prevent the water lodging, and the rougher the surface is left the better, as it protects the plant from cutting winds, and the land is not so liable to be washed by the constant rains. Wheat is still often cut with a hook, reaped, swived, or bagged. But all corn is more commonly mown, and neatly laid by the cradles which are attached to the scythes. The wheat is expertly and carefully bound, and immediately put into small "haddocks" or "mows." The foundation of the knee-mow is formed by placing four sheaves in a square on the ground, the ears of each sheaf resting on the lower end of the other. A circle is then formed, the sheaves having the ears inclined upwards and inwards. Fresh layers are made, each diminishing the circle, till at last at the top, four sheaves are placed nearly in an upright position. These are strongly connected together, and a small sheaf tied very near the ground end is placed with its ears downwards as a capping for the whole. The mow generally contains 100 to 120 sheaves, and when well made, will resist the weather six weeks or two months. In this humid climate the system cannot be too much commended, for in wet harvests, when corn is moderately dry, it can thus be preserved from harm; while, if placed in a large rick directly, it would invariably spoil. The farmer at his convenience drives the mows (perhaps after airing the sheaves) to his hay-guard, where they are placed in small well-made ricks—which are round, or stacks—which have four angles. The hay-guard or stack-yard is situated close to the barn, which is just large enough for two men to work and contain the corn for one day's thrashing. By the constant removal of the corn from the rick, much is left each day exposed to the weather and depredations of fowls. The thrashing is performed in the following manner:—A single sheaf is laid whole upon "the plank," which is formed of a number of boards attached together, elevated above the barn floor, and placed in a sloping position. The sheaf after repeated blows from the flail unties itself; and as the corn is knocked out, the straw is gradually thrashed off the plank, when a girl is always in attendance to shake out the loose grains and take it away. The wheaten straw is carefully made into bundles for thatch. The woman takes a handful of the straw, separates it, and shakes out what is loose, and short, and thus proceeds till she has procured sufficient for a small sheaf, which is then bound up. As soon as a new rick is made at harvest, it is immediately covered with these bundles, which secure it from the rain. The thatching takes place at some convenient time, which is performed in a dry state, with great strength and neatness. Till within the last few years winnowing machines were seldom met with; even now corn is often cleaned, by taking it to some exposed situation, where by throwing it up the wind blows the chaff away, while the grain falls on a large sheet. Corn is carried to markets, and there sold; but sales by samples are common in some districts. Grain is frequently sold by the weight, the bushel of wheat at 62 lbs., and barley at 52 lbs.* As this year, the weight of both grains is 4 or 5 lbs. under that standard, the averages are made erroneously high, for they are returned at so much per bushel, whereas that is really the price of a bushel and

---

* By the repealed Act of 31 Geo. III. c. 30, the following weight was deemed equal to a Winchester bushel, viz.:—Wheat, 57 lbs.; barley, 49 lbs.; oats, 38 lbs.

4 or 5 lbs. In the interior of the country the prices of the corn are often much higher than the English markets, though of inferior quality; but the whole of the transactions are of a very retail character, and no quantity of any grain can be disposed of at once. For *barley,* two of the small wheat ridges are ploughed together, which is two yards wide. In the spring the land is harrowed, and this is often performed in a very curious manner. First, a large square harrow, to which the horses are attached at the corner,—and at the other extremity is fastened by a rope or chain about a yard long a smaller harrow. The horses always *trot,* and the animals and boys are better fed when performing this sort of work. It is supposed the loose and rapid action of the small harrow behind, pulverises the ground better, and more effectually shakes out the couch grass. Two bushels of barley are then sown and ploughed in, and two more bushels sown in the top; the sowing all above the furrow is becoming more general. The season for putting in barley is generally from the first week in April to the middle of May. The harvesting the barley is similar to that of wheat, only the barley is allowed to lie some time before binding, to permit the weeds and clover to wither. With the exception that 5 or 6 bushels of seed are used, the cultivation of oats is the same as barley. Perhaps the land may remain unploughed till the spring, and then be sown on one furrow. About 8 lbs. of red clover (Trifolium pratense) and half a bushel of rye grass is the general quantity of seed sown when laid down for grass. The rye grass-seed is generally grown by the farmer, or by some neighbour, and not unfrequently collected from the hay. It is therefore often impregnated with large quantities of couch (Agropyrum repens); and if the land were laid down clean, *the seed applied is sufficient to poison it.* It is needless to state that land returned to grass in this impoverished and foul state can grow very little. The clover makes a feeble effort to distinguish itself during the first year, and then naturally dies away. The field for the next four or five years presents a whity brown appearance, and sends forth nothing but sour unprofitable herbage, and is often covered with furzes, brambles, and undisturbed mole-hills, which tend still more to lessen its produce. It is a curious fact, that land laid down even in this exhausted state, will, after a term of rest, again produce very fair crops when broken up.

A rough Debtor and Creditor Account (without interest of capital, &c.) of one acre for ten years, may perhaps assist in conveying a general idea of the amount of produce and profit or loss under the old system. Good land would stand about thus; and as nothing is charged for straw, the manure is put at a very low rate:—

Years.	Crops.	Rent, Tithes, &c.	Cultivation and Expenses.	Muck and Lime.	Seed.	Outlay.	Produce.	Receipts.
		s.	*s. d.*	*s.*	*s. d.*	*£. s. d.*		*£. s. d.*
1	Fallow .	26	40 0	75	..	7 1 0	Nil	0 0 0
2	Wheat .	26	25 0	..	22 9	3 13 9	24 bush. at 6*s.* 6*d.*	7 16 0
3	Barley .	26	30 0	..	14 0	3 10 0	32 do. 3*s.* 6*d.*	5 12 0
4	Oats . .	26	25 0	..	12 0	3 3 0	36 do. 2*s.* .	3 12 0
5	Barley .	26	30 0	30	14 0	5 0 0	24 do. 3*s.* 3*d.*	3 18 0
6	Clover .	26	14 0	..	10 0	2 10 0	Hay, &c. . . .	2 10 0
7	Grass .	26	2 6	..	..	1 8 6	Grass	1 10 0
8	Do. .	26	2 6	..	..	1 8 6	Do.	1 5 0
9	Do. .	26	2 6	..	..	1 8 6	Do.	1 0 0
10	Do. .	26	2 6	..	..	1 8 6	Do.	1 0 0
							Loss	2 8 9
						30 11 9		30 11 9

Inferior land might stand as follows for ten years :—

Years.	Crops.	Rent, Tithes, &c.	Labour and Cultivation.	Muck and Lime.	Seed.	Outlay.	Produce.	Receipts.
		s.	*s.*	*s.*	*s.*	*£. s. d.*		*£. s. d.*
1	Fallow .	12	40	60	..	5 12 0	Nil	0 0 0
2	Wheat .	12	25	..	21	2 18 0	15 bushels, at 6*s.*	4 10 0
3	Barley .	12	30	..	13	2 15 0	24 do. 3*s.* 3*d.*	3 18 0
4	Oats . .	12	30	..	12	2 14 0	28 do. 2*s.* .	2 16 0
5	Clover .	12	2	..	10	1 4 0	Clover . . .	1 4 0
6	Grass .	12	2	..	..	0 14 0	Grass	0 16 0
7	Do. .	12	2	..	..	0 14 0	Do.	0 14 0
8	Do. .	12	2	..	..	0 14 0	Do.	0 12 0
9	Do. .	12	2	..	..	0 14 0	Do.	0 12 0
10	Do. .	12	2	..	..	0 14 0	Do.	0 12 0
							Loss	2 19 0
						18 13 0		18 13 0

But it will be naturally asked, If this be a fair statement, how do the farmers live? They depend chiefly on the young stock to pay the rent, and rely on the dairy, which continually brings in ready money to meet other current expenses. In addition to this the small farmer and his sons do the principal work and repairs of the farm. They have thus hardly any outgoings for labour or tradesmen's wages, and they live in a style of patriarchal simplicity almost entirely on the produce of their own land.

Turnips are the first of the occasional crops that are met with, and they are generally drilled on 27 inch ridges, though in many instances they are sown broadcast and *not hoed.* Sometimes dung is used alone, occasionally combined with artificial manure, but good crops are obtained from 3 cwt. of guano. In more arid climates summer heat is reckoned as one great foe to turnip culture, but here it is *summer moisture;* for, although it nourishes the turnip, it also encourages the growth of weeds and natural grasses, and renders it difficult, even with repeated hoeings, to keep the land clean. With tolerable culture heavy good crops of swedes are raised, frequently weighing from 15 to 30 tons per acre. Turnips are not often consumed on the land, and spring wheat, succeeded by barley, generally follows. As the frost is seldom so severe as to injure turnips, the bulbs frequently show a gradual increase throughout the entire winter; early clamping is never practised.

Potatoes were formerly very successfully cultivated; since the appearance of the disease the extent sown has been reduced, while that of turnips has been proportionably increased. Large quantities of manure are applied, and in some cases paring and burning is used as a preparation for the crop. Formerly the planting of this root did not take place till after the barley was sown, but since the appearance of the disease early planting has become universal, and March is generally the month for setting the potato. Last year the disease attacked the crop with greater virulence than has been known, with the exception of the season when it first made its appearance.

Beans are seldom grown but in certain localities, as Laugharne and the stiff lias clays of Glamorgan. Peas and rye are not so much cultivated as formerly. Flax has been more noticed within the last few years. It generally flourishes well, and in some parts it springs spontaneously. The seed would be of great value in this stock-rearing country, as linseed gruel is particularly nourishing to calves.

In returning land to permanent *grass*, it was common in old times to sow no seeds, and this was practised in many parts when Mr. Davies wrote his report in 1814, and it is probable that our finest old pastures were thus laid down. The farmer of the Eastern and Midland counties of England would be surprised to see how rapidly the good and even middling soils of South Wales return to their natural grass. Mr. Hassell, in his original report, says, "that, in Laugharne, barley stubble, without seeds, will recover its sward and produce good crops of hay and grass;" and that throughout Carmarthen "land not run out of condition will naturally become good pasture." And he says of Pembroke, "The mildness of the climate and the perpetual vegetation that is going on, even in the winter months, seem in so peculiar a manner favourable to grass, that we cannot but lament to see so much under the plough." In Radnorshire "the arable land, if left unploughed, is soon covered with natural grass;" and on the limestone near Merthyr Tydvil, "if barley is sown one year and the land left to rest till next year, the white clover abounds so much that it may be profitably *mown*." So much for the spontaneous production of grasses at the conclusion of the last century; it points out most forcibly that South Wales is naturally a rich pastoral district. Still the proportion of good grazing land to that of pasture is very small. The present management of the meadows and pastures does not present any particular feature. The land is principally stocked with cows and young cattle; comparatively few sheep are kept. Not a great quantity is cut for hay, and then, to have the most, it is frequently left till it is too old. Mowing the meadow generally begins in the middle of July. All hay (clover as well) is scattered about as soon as cut, and allowed to dry in the sun: not being cocked up at night, but exposed to the heavy dews, &c., it soon loses the fresh green appearance so much prized in England. When sufficiently withered on one side, it is turned, afterwards raked into rows, and put into small lumps, which, not being compactly made, are easily wetted through. On a fine day these heaps are thrown out and carted to the rick. The hay is not pitched from the cart, but the load is tripped up, and the pitcher *takes it off the ground!* When it becomes too high for this, a ladder is placed by the rick and a labourer stationed on it: the pitcher from below hands him a forkfull of hay, the same fork and the hay pass up to the man above, who receives the burden and returns the fork. It is not often that hay is well saved in South Wales: the humidity of the atmosphere and the frequent rains of July baffle and confound the most skilful management.

Fogging is, I believe, peculiar to South Wales, and is still practised extensively in some counties. Cattle are taken out of the pastures in May or June, and the year's crop of grass remains untouched till the following spring. It is asserted that an acre of fog will keep more stock and in better condition than an acre of hay, besides avoiding the risk and expense of haymaking. Mr. Hassell, in his original Report of Pembroke, says—" By this practice, the farmer provides a good stock of keep for that season of the year when he stands most in need of it, puts his cows into good plight for calving, saves a great deal of hay, and improves his grass-land by the quantity of seeds shed upon the surface by the fogged grass; and his stock, being on the fog by day and in his straw-yard by night, augments his dung." The old grass shelters and draws up the tender shoot sooner than if it were exposed to the bleak winds and frosty air of an early cold spring. The old herbage combines beneficially with the succulent young grass, and cows produce an immense increase of milk when fed on it. Such are the grounds advanced by the defenders of the system; the arguments that are brought to bear against it are too well known to be here repeated. However, in the present state of farming, with no turnips, early vetches, rye, &c., and a generally late spring, I am not aware how in this district a more plentiful supply of early keep can be produced.

Top-dressings are not often resorted to; sometimes lime is used alone, but more commonly it is mixed with mud or other mould, and spread over the surface during winter. Irrigation is not practised further than turning the water from the yards or a road-side ditch across a meadow. This is done simply by running a furrow out with a plough, and when that portion of the land has received its share another is drawn in a different direction and the former one is closed up. A great many instances occur in which a *hill-side spring* might be made, *at a trivial expense*, of immense service by irrigating some of the pastures below it.

The *cattle* of South Wales are principally the Pembrokes and Glamorgans. There are many runts in the upper district complete nondescripts, being the result of complicated crosses with all the Welsh breeds. The introduction of the West Highlanders has much improved these cattle in parts of Cardigan and Radnor. By the borders of England many excellent dairies of Herefords are found, some possessing qualities of very considerable merit. These cattle are well treated and carefully fattened, and I may mention that last year Wales contributed two splendid Hereford oxen to the Smithfield Show.

The Pembrokes are a coal black, with large yellow horns tipped with black and turning upwards, a clean light head and neck, and a bright prominent eye. The forequarters of these cattle are heavy and well made, but they are often deficient in width across the loin and in roundness of rib. They are excellent workers, active and hardy, but now not much used in the plough. In the neighbourhood of the collieries a great number are yoked in carts with one or two horses before them. The West Wales carters, when driving oxen or horses with heavy burdens, are constantly seated on the load, and it is very difficult to prevent this unfeeling practice. Oxen were formerly worked in ploughs behind two horses, but farmers find that two horses *tolerably kept* are sufficient alone, and have therefore *discarded the oxen.* These cattle feed best on rich pastures, are sometimes restless and quarrelsome in open yards, but graze well in loose boxes or when stall-fed. An ox when fat at four years' old will generally weigh 7 or 8 cwt., and they always prove better to the butcher than their outside appearance indicates. The cows are capital milkers if well kept, and even on ordinary pastures give a good quantity; in summer the best will average 6 or 7 lbs. of butter per week. A more useful and hardy race of cattle are not to be found in the kingdom, and with care and attention they are capable of much improvement. Some successful crosses have been made with the North Devons. The best Pembroke cattle are bred in the district of Castle Martin, and they are principally called by the name of that hundred.

The Glamorgans are generally a ruddy brown, with white along the back and belly; they will not graze when young, and have too often flat blacks and high rumps: they are very superior cattle to work, and the cows are kind milkers, averaging perhaps from 16 to 18 quarts per day.

The other black runts are extremely hardy, but small and light fleshed, with thick hard hides, and show little disposition to fatten. There were formerly some good red, brindled, and smoky-faced cattle in the hilly parts of Radnor, but they have lost much of their distinctive character by crossing with the Shropshire and Hereford cattle.

In the internal management of the dairy the Welsh are clean, economical, and successful: they make a large quantity of capital butter, but the cheese is hard and poor. There is not much prospect of the cattle in the interior of the Principality improving, as too little attention is generally paid to the selection of the male animal. Cows also are valued only for their milk; indeed, if one should present any fattening qualities, the first time beef is dear and she is dry, she is sure to be sold; while the good milkers are frequently kept till they are much too old. The calves are dropped in the field, and run with the dam for three days or a week; they are then weaned, and generally fed on skimmed milk, and by degrees are taught to eat hay; during this time they are huddled together in dark close cribs. As soon as there is grass, they are turned out, and it is no unfrequent occurrence to see stock of all ages, from the cow to the yearling, grazing in the same field. In the following winter they are exposed to the violent gales and sudden changes of the atmosphere, being supplied with a scanty allowance of hay under the hedge-rows; the older cattle wander over the grass-land, and have some of the coarser hay or barley-straw. At three years old they are generally brought to the fairs and sold to the drovers, who dispose of them for grazing on the rich pastures of the Midland counties of England. The district is at present fortunately free from the ravages of the small-pox in sheep, and also from the pleuropneumonia and epizootic epidemic which has caused such frightful havoc among the cattle of England.

The native or mountain *sheep* of Wales are very small, with white faces, short coarse wool, and numbers of them are horned. They are extremely hardy, and very active. This class is found in the open elevated lands and high mountains of the interior of the country. They are under no particular system of management, but follow the dictates of their sagacious instinct. They are not so much kept as formerly, being a great hindrance to improved tillage. Hardly any fence will stop them, and they constantly *commit nocturnal depredations on the corn-fields*, and are sufficiently subtle to retire to their rugged domain before the return of day. Flocks of the neighbouring farmers constantly mingle together, and are distinguished only by marks. They drop the lambs at any period of the early summer, and the ewes supply large quantities of milk: in some districts it is still common to milk the ewes for two months after the lambs are weaned; the milk is principally manufactured into cheese. The mountain sheep will graze well when removed to better pasture, but it is very difficult to restrain their rambling propensities. Some of these little creatures are constantly to be met with in Smithfield, where they are much prized as Welsh mutton. As we descend to the more level country, a larger style of sheep is met with, which is produced by crosses with English breeds—all retaining marked traces of the Welsh blood. The Glamorgan Vale sheep have long been naturalized to that tract of country, and are heavy, good animals. Occasionally flocks of Leicesters and Downs are to be seen, but not often in their purity, as the cross-bred sheep are more in favour than the pure-bred animal. Almost every farmer keeps a few ewes, from 10 to 60, according to the extent of his land. The produce is either sold off as fat lamb or disposed of to the butcher before they are twelve months' old, as the ewes are good milkers, and they are well kept through the summer and autumn, but there is no winter provender. This is the cause that the markets are so frequently supplied with meat which is neither lamb nor mutton, and not the sheep "killed at 18 months old," as mentioned by Mr. Davies. The sheep are kept in the pastures all the year round; should there be a heavy fall of snow, they are provided with a little hay. In districts where turnips are grown they are not often folded on the land, but the turnips are thrown on the pastures for them.

The Welsh *hog* is distinguished by his large size, long pendant ears, coarse bristles, and thickness of bone. They are generally reared where there is a dairy, and those kept for bacon are killed at about eighteen months or two years old, and will weigh from 16 to 22 score. They are great consumers, and now that potatoes are so scarce it is found very unprofitable to feed them, as the price of the fresh meat seldom exceeds 4*d.* or 5*d.* per lb. Swedes chopped fine and boiled with meal will be found a good substitute for the potatoes. A large pig of this description requires quantity as well as quality of food, and if fed entirely on barley-meal they will soon cease to be fatted at all. Crossed with the Berkshire, these pigs retain the great size of the original stock and the early maturity of the English breed; still for bacon the old sort is preferred on account of the great quantity of lean in proportion to the fat. Every labourer strives to have his pig, which is reared with great care. They are not confined to styes, but are fed from a bucket near the cottage door seven or eight times in a day. They roam all about the roads and lanes, and retire to their hovel at night. In the summer it is customary to boil the refuse of the garden and even wild herbs with the bran that is sifted from the barley and oatmeal. In this way a pig is brought to a large size, with great solicitude and little expense. Barley-meal is generally used for fattening, and a pig will consume 10 or 15 bushels. When killed, the meat is salted and hung up in the roof to dry. The short-eared pigs are common in the flat districts, where they are generally killed at an early age as porkers.

The *cart-horses* are small, but naturally hardy and active. They are reared, like the cattle, entirely abroad, worked at a very early age, and frequently badly fed. It cannot therefore be wondered that many are sluggish and of a very mean description, not capable of real work for two days together. The tender shoot of the young furze, bruised or cut into chaff, forms with some the principal winter provender; with others a small supply of poor hay, plenty of barley straw, pea haulm, and corn chaff. There still exists the practice of baiting cart-horses in a close stable till eight o'clock on a cold night, and then turning them out to grass! They feed on the pastures as long as there is anything to be had, and the allowance of oats in the spring (*if any*) is scanty in the extreme. The old Welsh punch is much degenerated by injudicious crosses with high-bred animals, which makes them too light and delicate. Another evil is common, viz. that of breeding from very old, diseased, and worn-up mares.

The management of the *farm-yard manure* is truly distressing, and, as if rotten straw and a little dung was not poor enough, all means of retaining the few fertilizers it possesses are totally disregarded. Cows being the stock kept, the manure is mainly made by them. When brought up to be milked they are driven to a large enclosure, called "a court," or to a "milking back," where they amuse themselves with picking over various lumps of straw, laid promiscuously about, and treading the remains of the last meal into manure. The cleanings of the hovels in which the calves or tender yearlings are kept, .are thrown in heaps by the door into the same court, where all alike are dried by the sun and washed by the rain. Some streams run through the farm-yard, which carry away much of its richness into the next brook.

The use of *sea-sand* and *sea-weed,* or "ore," as manure has been long known, for in the reign of Queen Elizabeth Mr. George Owen thus wrote:—"This kind of ore they often gather and lay on great heapes, where it heteth and rotteth, and will have a strong and loathsome smell; when being so rotten they cast on the land, as they do their muck, and thereof springeth good corn, especially barley." And again of sea-weed, "After spring-tydes, or great rigs of the sea, they fetch it in sacks on horse backes, and carie the same three, four, or five miles, and cast it on the lande, which doth very much better the ground for corn and grass." These spoils of the ocean are found in great quantities in many maritime positions, but chiefly on the Western Coast. Some lay the sea-weed fresh on the land, and immediately plough it in; others, as of old, put it in heaps to ferment. Alternate layers of farm-yard dung and ore produce an excellent compost, as the saline juices of the seaweed do not escape (as is frequently the case if placed by itself), but mix with the manure, which thus in an eminent degree retains its moisture in hot weather. It was till lately successfully applied in a fresh state as a dressing for potatoes. The sea-sand is highly calcareous, containing large quantities of pulverized shells. It is applied at the rate of 10 to 20 loads per acre, and is considered serviceable in destroying many weeds which the overcropped land naturally produces.

Lime is extensively used in South Wales. In districts it is very plentiful: some places can be supplied by water, while in many others none can be obtained but by a long and hilly land-carriage. In some tracts it is common to send for lime 20 or 30 miles! The numerous heavy tolls, which in long journeys amounted to a serious sum, were the principal causes of the Rebecca riots. When far fetched, the lime is applied with much skill and judgment, but too much at once is frequently used where it can be easily had. The quantity applied per acre is often regulated by the price, and ranges from 60 to 250 bushels per acre. Extraordinary heavy limings are frequently given to the stiff loams in the Vale of Glamorgan, and Mr. Davies mentions several cases which averaged for sixty years 100 bushels per acre every year! It may be as well to state, that this buff-coloured lime is not so strong a manure by nearly *one half* as that of the calcined carboniferous limestone. Of course the price, therefore, varies with the locality. In Cardigan it is sometimes 7*d.* or 8*d.* per bushel, while in the southern parts of Pembroke it can be produced for 3*d.*

Marl was anciently much used as a manure. It is said to have been first discovered by one Cole, a Frenchman, in the twelfth century. It is much prized by the historian already quoted, for he says, "It will carry barlie, wheat, and peas continually for twentie yeares without dong." This clay-marl is described as being of a "blewe coller, sometimes redd," fat and clammy, more adapted for loose, dry land than moist, where "lyme rather serveth than this." It was considered much more durable than sand or lime, for the old adage says, "that a man doth sand for himselfe, lyme for his sonne, and marle for his grandchilde." Marl abounds chiefly in the north of Pembroke and south of Cardigan, but is hardly ever applied to land now, being entirely superseded by lime. I have merely noted these ancient records, as it appears strange so lasting a fertilizer on the spot should be universally neglected, while a more active, though transient, stimulant is procured from such a distance.

Peat is sometimes used as a manure, and has been successfully burned with lime, but is more frequently made into a compost.

Coal-ashes, which are obtained in large quantities in the vicinity of the Iron Works, are very useful, especially as a top dressing for grass-land.

The operation of *paring and burning* is often resorted to, especially in marshy and peaty grounds, as a preparation for corn-crops. In this manner the cleaning and breaking up land that is under furze, &c., is done in a neat and husbandlike manner. The first crop is generally prime, but land is frequently cropped to sterility, and this occasions the system to be much spoken against. It is condemned so far back as the sixteenth century, for it is the opinion of the Lord of Kemmes that "in the most mountenous partes which grow nothing but heathe and small furse, and shallow with all, this kind of ill husbandrie may be borne, but those who use this kind of *betting* in land, which otherwise would have been tilled to better advantage, are much to be blamed for doing themselves, the land, and the countrye harm." Land that has undergone this process is still called bet-land, and there cannot be a doubt that it stimulates the soil by bringing its inert properties into a condition available for the support of crops, while the continued practice of taking corn without manure must ultimately impoverish the ground. In reclaiming wastes, especially a morass or bog, paring and burning is, in the first instance, not only very useful but frequently indispensable. Except where much peaty earth abounds, its subsequent application cannot be commended.

The only *artificial manure* which has been extensively tried is guano, which (when good) has been found to answer admirably for corns, root-crops, and grass; indeed, the effects are sometimes double those which are produced by the same manure in the East of England. The beneficial influences of all manures exhibit themselves most rapidly. The great activity and increased luxuriance which is imparted to all crops by the application of good fertilizers, is conspicuous to any one who has seen the small returns produced by the heavy dressings given to the gravels of Norfolk. It is supposed, however, that the effect being so immediate and extensive will be less lasting.

A better class of *implements* is becoming at last gradually more appreciated. The old Welsh plough, with its mould-board of wood, is being superseded by a light iron swing-plough. In the

Upper District still many of the implements are made in the most rustic style possible, and the cumbersome, ill-shaped, old plough (sometimes 13 or 14 feet long) continues much in favour, especially for the small wheat ridges. There are very few waggons; light carts, drawn by two horses, with moveable frames, &c., perform all work. In the flat country there are more thrashing-machines than are usually seen in England, and some are propelled by water. Cultivators, drags, &c., are here daily becoming more abundant. In many tracts the uneven nature of the ground will not admit of the use of the drill, but on level land all corn is commonly sown broadcast.

The *enclosures* are generally small. The banks are from 5 to 8 feet high, and with the ditches sometimes occupy from 20 to 30 feet. The banks are made nearly perpendicular, with two shallow ditches, and each side faced with sods. The quicksets are small bushes of hawthorn, hazel, blackthorn, alder, and willow grubbed up in copses or ditches, trimmed and planted upright on the top of the bank. By the sea coast, and through the red soil and coal tracts, there are some dry stone walls, but more frequently banks of alternate layers of stones and sods. Where exposed to the fierce winds, these and the common sod fences are left without any quickset, but double rows of furzes sown and kept constantly trimmed have been found to grow well in any situation. The high banks are considered to render much service as shelter to the cattle, and there can be no doubt they are a great protection to the young stock, which are fed with hay and lodge under them during the entire winter; but shelter cannot be required for the ridiculously small, ill-shaped fields that are everywhere met with, having huge banks which occupy nearly one-fourth of the land. Extensive fields are not desirable; one from 10 to 15 acres is large enough. A good hedge-row will break the severe gale that sweeps across the country from the sea, and thus protect the young grasses and winter crops; and, till the farm-buildings afford more accommodation, the cattle must find shelter from the storm somewhere in the open fields. The gates are usually narrow; in woodless tracts the gate-posts are formed of stones. Frequently the opening into fields is stopped up with dry stone walling, or furze and stakes; and often the gates are rudely constructed with four light poles, the uppermost resting in a mortice cut in the post.

The *wastes* of the upland tracts are stocked with small black cattle, mountain sheep, and ponies. They feed to the summit of the highest hills during the summer, but retire to the warm and sheltered spots as the severe weather approaches. Much of the land of South Wales was recently undivided, but in the early part of the present century most extensive enclosures were made, and since Mr. Davies made his report much more has been taken in. The principal wastes which still remain unenclosed are too elevated and rugged to be successfully cultivated, and, taking the whole district, there is not now so much open improvable land as in many parts of England. But there are nearly 5000 acres of *fen* and *marsh* land near Tregoran, and about 6000 more by the mouth of the Dovey, both in Cardigan. These moors remain in the same state as mentioned in 1814, though, if drained, they could be made *some of the best land in that country.* The inequalities of the surface of the country render it in a peculiar manner adapted to the growth of timber, and, if the mountain sheep and cattle are fenced out, the rough declivities will soon be crowded with oak, ash, or alder. The beautiful slopes and dingles of the Wye afford continual instances of these natural plantations. Even Pembroke, whose exposure to the westerly winds is now considered unfavourable for timber, was once covered with woods, but they have gradually become less and less. Thus, in the time of Elizabeth, the Lord of Kemmes, in his M. N. S. History, says, " This country groneth with the general complainte of the decreasing of woods;" and a Mr. Lewis, in the reign of Queen Anne, observes on this, " If there was such cause of complaint then, how is that cause increased in the course of another century!" Mr. Hassell, in 1793, says, " The stock of timber is so much reduced, that in a few years more the farmer must import wood for the purposes of husbandry," which he must certainly do now, did not the monthly sale of refuse timber at the Dockyard furnish a regular supply. Many of the woods mentioned in the last report have since been felled. If there was such a quantity of timber in Wales in old time, why cannot it be grown now? Let the plantations of Stackpole and Brownslade, flourishing on the edge of the Atlantic, furnish a reply. Oak is the principal timber grown, and this is raised from the old stump, or stools, which are cut every fifteen or twenty years; and when the poles are peeled, they are easily disposed of for colliery purposes.

No part of the kingdom requires *draining* more than South Wales. The whole of the coal measures, and many soils on the red sandstone, are wet from innumerable springs which arise from the fissures of the rocks. The clay-slate formation and millstone-grit are also wet from this cause and surface-water; and, in fact, no large district of the country, except the limestone soils, can boast of being sufficiently dry. The West of England and South Wales Draining Company have commenced a move in the right direction in the eastern part of the Principality, but the effect of that progress is not felt in the interior or western portions; indeed, very rare instances of regular drainage have been attempted.

Some springs have been tapped, and a sort of catchwork system with stones may have been here and there tried.

So far back as the year 1794 the *farm-buildings* of the west counties were described as "incommodious, comfortless, and wretched;" and now, midway in the nineteenth century, the same epithets may be most appropriately applied. Glamorgan, which contains some fine specimens of old baronial and monastic barns, has been surpassed by Brecknock in its agricultural premises; but, taking the district generally, there is *an universal lack of farm-buildings.* A lease-tenant, when he takes possession of a farm, frequently sees that all his spare capital must be expended on his homestead, instead of being employed in draining and other legitimate improvements of the soil. But it is not only on farms without leases that there are no buildings; where the tenants are from year to year they are equally bad, several premises being *without a single enclosed yard!* Many farmers, when told to grow turnips, reply, "What is the use of growing turnips when we have no sheds to eat them in?" But, it having been the custom formerly for tenants who had taken *cheap* leases to build premises, there appears to be an erroneous impression that all tenants can and ought to do the same!

The average rental of farms may be considered as under 40*l.* per annum. The smaller holdings are generally dearer in proportion than the larger farm, simply, it is supposed, because there are so many competitors for small parcels of land. There are some few leases granted for 999 years, and others for "as long as the sun rises and water flows;" but generally *the leases are for lives.* Those that were granted many years ago are frequently uncommonly cheap, but what have been recently made exhibit an increase of rent on the old ones from 50 to 300 per cent., and land is now let at its extreme value. It is a singular fact, that cheap leases frequently made the Welsh tenant indolent and careless, and that an increase of rent has bettered his condition, by making him a more active and industrious farmer! But too high rents are now frequently required, and little attention is paid to the character and pecuniary circumstances of the tenant. The man who gives more than land is really worth is often one who has everything to gain and nothing to lose. From these and other causes the capital of many of the tenantry is utterly inadequate for the proper cultivation of the land. The common practice of giving six months' credit at all agricultural sales will show the usual style of money transactions. The lease in the western counties is often granted for three lives, and may include that of the occupier and two of his children. There are no restrictive clauses as to cropping or selling any kind of produce, and nothing is said about covenants to be observed at the expiration of the term. Certain pastures are not to be broken up, and the landlord reserves the game, timber, and the right to dig for minerals, &c. The tenant is bound to keep the house and all buildings in proper repair. It is the custom of the country, when a lease expires, to remove all produce, even hay and straw. The entry is commonly at Old Michaelmas. Should a landlord distrain for rent, the tenant does not necessarily quit the holding, but strives to struggle on and patch up his broken fortune. These leases are liked by the tenantry as giving ample security for all outlay, and the landlords are relieved from all burdens but the taxes, and it is impossible, from the uncertainty of life, to run a farm out of condition with the exactness which is often practised where the term is for a specified number of years. "It is the nature of man to flatter himself and hope for the best, by putting the evil day of dying far off; thus hope comforts the tenant, and uncertainty the landlord." Leases for the life of the tenant only and for a term of years are more common in the east, and these are more particularly framed. Many landlords have entirely dropped the practice of granting leases, and let all their farms from year to year.

The *peasantry* of West Wales are contented and thrifty. Their wages are not often more than 6*s*. in the upper, and 7*s*. per week in the lower country. It is customary to board the labourers wholly or in part during harvest, giving them the same wages. They are neat and skilful in some of the minor branches of husbandry, but in general field work, where strength and exertion are required, are much inferior to English labourers; indeed a Lincolnshire workman at *half-a-crown* a day is not dearer than most Welsh labourers *at a shilling*. In support of this, I may state that task-work (which is seldom heard of here) cannot be done cheaper in Wales than in the east of England. This is naturally the case; a man who consumes *wheaten bread* and *meat* must be in better working trim than the man who eats *barley cake* and a *little butter ;* and until the Welsh labourers are better fed they cannot be physically capable of sustaining with equal ease the fatigues of a hard day's work. Their principal diet is oat and barley-meal merely moistened with water and made into cakes. These cakes are pressed very thin, and baked on an iron plank upon the fire. Barley bread is made in large loaves fermented with leaven. Sometimes they eat oatmeal and buttermilk, and a common beverage is extracted from the husk of the oat. The farm cottages are built on the ground floor, and the rent with a good garden is in the upper country from 30*s*. to 40*s*., and in the low lands from 40*s*. to 50*s*. per annum. If possible the spot selected for building is close by a spring, but often it is so near that it renders the floor damp and cold. The walls are now made of stones and mortar, the roofs thatched or slated. The cottages built with mud, of which Mr. Davies hopes the description he gives "may be the only existing memorials of such dwellings in less than half a century," are rapidly on the decline. As they fall down one built of stone is generally substituted. Whitewashing the exterior, which is mentioned by a Welsh bard in the *sixth* century, is still universally practised. In many districts it is common to mix clay with the lime for colouring the walls yellow, and the slate roofs are washed white! The interior is divided into two apartments; one, in which the principal culinary operations are performed, and the other is used for meals, &c., and contains the beds, which are like high boxes with sliding panels. The windows are very small, and the rooms are damp, close, and dark. The fuel consists, in some districts, of peat, with furze and fern, in others culm,* and the anthracite and bituminous coal. The women are frugal, cleanly, and industrious. They are well skilled in manufacturing coarse cloth, but are singularly awkward at needle-work. Strangers generally notice the market-women, who knit and carry their baskets on their heads. They do not work much in the fields but in hay and corn harvests. Most of the farmers have some lads, or single men, who board and lodge in the house, and look after the farm-horses. In some instances labourers have smaller wages and the keep of their cow; occasionally the privilege of setting potatoes in the field. Farm-labourers are generally hired by the year, not by the day, and then mostly have their corn from the farmer at a fixed price. The religious and secular education of the poor throughout this portion of the principality is very much neglected; lately considerable efforts have been made to provide more ample instruction. In thus noticing the education of the poor, it would be well to say a word upon the amount of instruction generally given to the young farmer. Not only is it (as is generally the case) totally deficient in providing a scientific knowledge of his future occupation, but the common rudiments of a sound and plain education are frequently dispensed with. The fact that commercial schools are rarely to be met with, will at once explain the numerous defects that must occur in the Welsh farmer's early education.

To glance at some of the important improvements which have taken place in the well-farmed districts, will now be a more pleasing task; but as the description of the agriculture of the

---

* Culm is the dust of the stone-coal, and is prepared for burning by being mixed with clay or mud from the shore. It is then made into balls, and in a moist state applied to the fire, and it produces no smoke. At night a casing of this wet culm is placed on the fire, which keeps in well twelve hours, and thus forms a cheap and convenient fuel.

interior of the country has already occupied so much space and time, the limits of a report will not admit of more than a few passing remarks on each locality. When Mr. Davies made his report in 1814, the only three districts that produced any extent of turnips were the vales of the Usk and the Wye, and a portion of the plain of Glamorgan. The root was even here imperfectly cultivated, for we read, "the common farmers sow broadcast, and take chance crops, thick or thin, clean or not." The turnips were often harrowed to thin them, and this was supposed to supersede the necessity of hoeing them; and it is further remarked, "too many are left entirely in the state of nature."

Beginning at the west, the first tract that claims our attention is that of *Castle Martin* and the *South of Pembroke*. The course of cropping mentioned in 1814 was, at St. Florence—"1. Wheat, on limed fallow; 2. Barley; 3. Peas; 4. Barley or Oats laid down with grass-seed." In Castle Martin: "Wheat, on limed fallow; Barley; Barley; Barley. Produce of first barley crop, 28 bushels; second, 10 to 20 bushels; and third still less." In the Hundred of Roose: "Fallow, wheat, clover, wheat; and oats." Turnips now form part of almost every rotation, though the courses are very various. The following are among the principal: Fallow (well limed and manured), wheat, turnips, wheat, barley, clover; fallow, wheat, barley, turnips, wheat, barley, clover; wheat (on ley), barley, turnips, wheat, barley, clover; oats, turnips, wheat, barley, clover; and on some of the land unkind for the production of turnips, the Welsh system moderated is still used. After some of these courses, the land perhaps remains from two to four years in grass, generally mown the first season, and depastured the rest of the time. The management of corn and hay harvests, and the principal operations of husbandry, are pursued on the same principle as has been related, but of course in a better and more effectual manner. The superiority of the farming diminishes as it proceeds inland; and above Narbeth the Welsh county commences. Indeed few good crops of corn, and still fewer turnips, are seen north of the red soil, for the coal-measures are wet, barren, and generally produce inferior grain, and the pastures are crowded with furze and brambles.

When Mr. Davies visited *Laugharne Marsh*, he found "the soil more to be commended than the management," and observed only one piece of fallow in the 3000 acres. He relates that forty successive white-straw crops had been taken without manure; and sums up the rotations as follows:—"Wheat, beans, barley, oats, barley; oats, then wheat again; and the same course repeated for twenty years, or rather from time out of mind." The marsh presents a very different appearance now. About 1,000 acres have since that period been reclaimed from the sea, which is now some of the best land in the level. Several Englishmen have taken large holdings here, and are farming well. They all commence their rotation with a white-straw crop, then barley, then turnips, and afterwards spring wheat or barley; if the former, they generally take a fifth crop before the seeds are sown, but this depends on the state of the land. Beans are sown over a considerable area, and very good crops are raised. When the land is laid down to grass it produces most superior pasturage, and one of the best oxen ever slaughtered in this part of the country was grazed here last year.

The neighbourhood of *Kidwelly* ought not to be passed by without some notice of its improved agriculture. The cropping of this tract in 1816 was mentioned as—1. Wheat, on limed fallow; 2. Barley; 3. Oats; 4. Barley, or the oat-stubble manured and sown with 4. Wheat; then 5. Barley; or without clover, to rest from labour 5 years. There are several enterprising farmers who now pursue the following and similar rotations:—Ley taken up and sown with oats, then cleaned with turnips, which are mostly eaten off by the sheep, then barley or spring wheat, and the last crop either barley or oats, with seeds. This mode is found to answer exceedingly well. Irrigating the pastures is here common; indeed all through the coal-fields the numerous springs or small streams are made to flow over the saturated clayey ground, which produces coarse inferior grass and, being undrained, plenty of rush. Below Kidwelly are extensive salt-marshes; nearer Swansea may be seen some successful instances of thorough draining the stiff clays of the coal-measures. This is generally performed by the landlord; but there are a few spirited tenants with twenty-one years' leases, who have tile-drained their farms, and the general rotation of crops that they practise is oats on ley, turnips, then barley with grass-seeds. Few sheep are kept in the western parts of Carmarthen; and the cattle are housed in the winter, as the land is so wet, that the stock could not select a dry spot to lie down on. The yearlings, steers, cows, &c., are all tied up in sheds; some receive a portion of hay, but they often subsist entirely on straw.

An intelligent correspondent having kindly forwarded me an account of the present state of the agriculture of *Gower,* I shall insert his remarks at length:—

"The western portion of the county of Glamorgan, called 'Gower,' may be termed a peninsula, being bounded by the Llanelly Channel on the north, and the Irish and Bristol Channels on the south and south-east.

"The surface, without rising into hills or mountains, is rather hilly or undulating, with occasional slopes and vales capable of being highly cultivated.

"At a rough estimate I should say that one-third of the entire surface is waste, a large portion of which is held in *common.*

"The most fertile, as well as the best cultivated, portions are those which are naturally dry, being a sort of table-land above the limestone-cliffs adjoining the sea, while the less favoured spots near the commons in the interior, which are under cultivation, are many of them not so dry, but quite capable of being made so, by the now well understood process of thorough draining. With these preliminary remarks we shall now proceed briefly to state the *system* of farming generally pursued in Gower.

"Truly and correctly speaking the farmers are without system—each and every one having a way of his own—which has possibly been pursued upon the same farm for centuries past; still they have some features in common, especially as regards their treatment of live stock. All whose holdings are large enough keep cattle, generally of the Glamorgan breed. The cows are kept as a sort of dairy; the principal produce sold from which is butter, generally of good quality. The cheese is miserable stuff, scarcely deserving the name. The calves are reared upon sour milk and whey, and when two years old, bear witness to the hard treatment they have received. The steers or oxen, when four years old, are sold to the dealers or drovers to be driven to the eastern counties of England, where they are re-sold to be fattened upon the fine grazing pastures of that district, for the London market. If anything is attempted to be fed off at home, it is generally some old cow which has become from age unfit for the purposes of the dairy.

"The sheep are, for the most part, of the small Welsh mountain breed; but as to their management there is literally none, unless it be that they are shorn of their wool. But ignorance in this important branch of rural economy is not confined to Gower, as it prevails at least over the county of Glamorgan. In a journey the other day by the mail-road, the writer cannot say that *he saw one flock free from scab* from Neath to Monmouth.

"The pigs are, for the most part, of the old 'lank and lean' sort, but of late some of a better breed have been introduced.

"There is now evidently a desire amongst the better class of farmers to introduce better breeds of cattle as well as sheep. Short-Horns, Herefords, and Devons of the best sort are now to be found; and sheep, although not of the best breed, yet of a larger size and more quiet habits, which is something, as a tolerable fence and a mountain Welsh sheep are seldom to be found in the same parish.

"Then as to the *Corn Crops.* There is for the most part some preparation for the wheat crop. A piece of foul and weedy ley is ploughed in May or June, and undergoes what is called a fallowing; that is, being ploughed two or three times, and harrowed, but *no weeds are picked or carried* from the land. In almost every case lime is applied; and sometimes, with good farmers, a little farm-yard dung. After the wheat-crop is removed, the stubble is ploughed in winter, and again a scratching of a seed-furrow in May for barley. Seeds, that is clover, &c., are sometimes put in with the barley crop, but rarely either in quantity or quality to be of any use. More often oats are taken after the barley, but the land by this time is so much exhausted and *rampant* with weeds, that you have some difficulty, in passing, *to tell what the crop upon the ground is.* There are instances of fields having been twenty or even thirty years in crop without ever having been seeded for grass.

"In Gower, as well as other places, much of the best lands are in hay-meadows, but these are often late in being cleared in spring, and late harvested hay is always of inferior quality.

"*Green Crops.*—Potatoes have been extensively cultivated, and bear a high character in the Swansea market. The late disease has been severe and destructive, but upon dry sandy soils by the sea the crops have been better than others. The mode of cultivation has nothing peculiar.

"Turnips and mangolds, until very recently, were scarcely known; now, however, the cultivation of these valuable roots is extending rapidly. The soil and climate seem well adapted to the habits of these plants, and as good turnips and mangolds have been grown in Gower as anywhere else in the kingdom.

"The example was first set by the present Lord Lieutenant of the county, who pursues the '*alternate husbandry*,' and only takes *one* crop of corn after grass, then the green crops. Turnips or mangolds, followed by spring wheat or barley, with which last crop the land is again sown down with clover and rye-grass seeds for pasture the following year.

"Good labourers willing to work are seldom unemployed. The money wages paid at present in the western part of Gower may be from 10*s.* to 11*s.* per week, but nearer Swansea they are higher; but those in the western parts have, for the most part, a few sheep on the adjoining commons, and, take it all and all, they would be unwilling to exchange places.

"The women and boys engaged in picking couch, hoeing turnips, and the like, get 10*d.* per day. Sometimes the farmers give victuals, and in that case the wages of a man are 1*s.* per day. But in estimating the wages of labour in different districts of the kingdom, cottage-rent and fuel always form an important consideration. Without inquiring into these and other perquisites, no correct comparison can be made. It is believed that, although the cottages are often very inferior upon the whole, the labourers are not over-rated as to rent.

"The farm-buildings are very far from being what they ought to be, and generally ill-calculated to carry forward an improved system of agriculture; but I have little doubt that landlords will be, for the most part, ready and willing to grant every encouragement in that respect to deserving tenants.

"*Rent of Land.*—It is rather difficult to form a correct estimate of the rents in this district, I believe they are thought to be low; and upon the whole, 14*s.* or 15*s.* per acre may be taken as about the average; still I have no hesitation in saying that, under proper culture, very much of the land is capable of paying a much higher rent than is now paid for it."

Having now arrived at the *Vale of Glamorgan*, it would be well just to mention some of the distinguishing features between the East and the counties just quitted. The general style of husbandry resembles that of England. Waggons are common, implements good, fine Hereford cattle and large sheep in abundance, and the young stock are sheltered during the winter. The wheat-sheaves when bound are placed in stocks, while barley and oats are gathered in a loose state, and so taken to the ricks; the humidity of the air being less, this can be successfully practised. The hay is made carefully, being regularly cocked up at night, and kept fresh and green by this judicious treatment. The large waggon-cocks do not appear so common as formerly. The cottages are more comfortable, and those of Glamorgan have long been celebrated for their superior architecture and neatness of thatch. The labourers consume wheaten bread and receive capital wages, while the numerous mineral-works increase the competition for labour and open extensive markets for all agriculture produce. The Vale of Glamorgan is, perhaps, the finest district and as well farmed as any in South Wales. Although Mr. Davies mentions a few courses connected with turnips, it appears that the wheat, or fallow succeeded by many corn-crops, was the principal; and sometimes, on the strong soils, wheat and beans for six years, and laid down for as many years. The fences, which were described "as capable of affording harbour for elephants," are now for the most part of moderate size, while the ricks still retain their superiority in neatness of construction. The entire absence of any *system* of cropping, so often mentioned, is here the same, and therefore renders the description of the improvement of its agriculture so difficult and complicated. After summing up all that I saw and the various information I obtained, it appears that some turnips are now grown by all farmers, that wheat is taken on ley; spring wheat or barley succeeds turnips; that beans and oats are seldom grown, summer fallows are becoming rare, and the grass-seeds lie from one to four years. Those farmers who still cherish the remnants of the old system, take three or four corn-crops in succession, while the more enlightened are satisfied with two at the most. A portion of the turnips is usually consumed on the land by the sheep or young cattle. The Glamorgans are principally kept, and many are stall-fed on hay and turnips at four years old. The yearlings are fed in sheds during the winter; in the day some turn them out to eat turnips in the fields, and take them in at night, while the two years old stock are treated in the same manner, but lodge in an open straw-yard. The Hereford cattle are more plentiful nearer Cardiff, and the general farming is of a very superior description in that locality. The labourers receive capital wages—from 10*s.* to 13*s.* per week, or from 10*l.* to 15*l.* a-year, and board and lodging. The miners at their task-work earn from 18*s.* to 40*s.* per week. Few leases are now granted. The land in the Vale is injured by the large quantities of hay and straw sent to the mineral districts, the loss of which, in almost every instance, is inadequately supplied by manure not made on the farm.

From the Brecknock Beacons Mr. Davies observed that the fallows in the *Vale of the Usk* were extremely numerous; and he expresses a wish that instead of " such ruddy fields, they were clothed with luxuriant turnips." It certainly does appear strange that such a porous silicious soil, in a comparatively dry climate, should have been so long treated with a summer fallow, which rendered the land insufficiently solid for wheat. It is supposed that, in the original deposition of soil in this beautiful valley, water washed much of the clayey portion into Monmouth, and thus left the reddish sand to form the principal ingredient of the soil. The following were the principal courses in 1814:—Wheat on fallow, barley, peas, barley, and clover; wheat on ley, succeeded by numerous corn-crops, and occasionally broad-cast turnips. Some few farmers of superior discernment practised turniping for barley, and took wheat on clover-ley with one furrow, to the total exclusion of summer fallow, and this has rapidly gained ground; and the four-course, or slight deviation from it, is now the common system. It appears that *the Vale of the Wye*, and some parts of Radnor, were treated with better rotations earlier than most parts of Wales, for we find it mentioned that the Flemish course, adulterated with summer fallows, was common at the time of the last Report. As has been already stated, the soils here are more clayey and stiff than in the Vale of Usk, but the farming is now precisely similar; and the following account of the tillage will explain the general system of this neighbourhood:—When land is intended for turnips it is made quite clean by frequent ploughings, scarifying, and harrowing, and then drilled with turnips on the ridge, 24 inches apart, manured either with farm-yard manure or artificial, such as guano, and bones dissolved with sulphuric acid. If the latter are used, two-thirds, and if the former, one-half of the turnips are consumed on the land by sheep folded, which are principally Leicesters. The remainder of the crop is brought to the farm-yard for the fat cattle, and also for young stock, which receive only the addition of straw.

I now come to the concluding portion of the Report, viz. "The improvements still required, with reference to the character and climate of South Wales." The advances which have been recently made in the eastern counties of South Wales argue well for a continued progress in agriculture, and those slight imperfections which still exist there may be easily removed by an enterprising and industrious tenant, with the assistance of a just and liberal landlord. It would therefore be great arrogance to suggest a series of improvements in such a rapidly progressing district, and the few humble remarks that follow will be found chiefly applicable to the interior and western portion of South Wales.

It would be well therefore to commence at the fountain-head—*draining*. It is perfectly unnecessary to advance arguments to support that which all commend, but draining is particularly wanted in South Wales, and till the land is made dry all other attempts at improvement will be abortive. There being so little sun and so much moisture in the atmosphere, it is highly necessary that the rays of the sun should *not* be employed in drawing off water from the land, but that they should proceed, without let or hindrance, to warm the soil and make the plant grow. The small amount of capital at the command of the tenantry renders it impossible for them to drain on a large scale. Giving them tiles would in many instances be a perfect waste of money, on account of the imperfect manner in which the draining would be performed. The only way therefore to hope for the accomplishment of such a desirable national object is for the landlords to perform it, and charge the tenants five per cent. on the outlay; and should the landlord not have a sufficiency of spare cash, fortunately the Drainage Act supplies money to all who condescend to apply. Still there are many impediments in the way. First, the absence of tiles and pipes. It has been suggested that a temporary kiln and a tile-making machine, under the direction of an experienced workman, would produce a great quantity very cheaply. There is plenty of clay in almost every district for the manufacture of pipes, and slates, when cut to the required size, form capital and cheap soles for the tiles. Again, the labourers have not the remotest idea of digging an underdrain; but happily there exists the West of England and South Wales Draining Company, who really perform the work, as they profess, in the most "scientific, economical, and effectual manner." If therefore one large proprietor, or several smaller ones, would unite and engage the Company to drain their estates, the most beneficial results must accrue. Independently of the increase of produce, &c., it would practically show the farmer the best way hereafter to dispose his drains, and the labourer would see how to dig the drain, manage the new-fashioned tools, and judiciously place the pipes. The influence might at first be confined to a small locality, but as the advantages became glaring, others, seeing its profit, would follow the example, and the result would probably be that a large district would be *effectually* drained. It has been found that in draining the majority of land here, a regular system should be pursued, for the soil is so frequently injured by the combined influence of springs and surface-water, that nothing short of thorough drainage on such ground will be found satisfactory. The imperfect manner in which draining has been hitherto executed causes it to be so little appreciated. This must have been the case in Mr. Davies's time, or such an able and learned writer could not have asserted that covered drains in clayey land was an "ideal improvement," or recommended stone drains "to be covered with gravel to the very surface."

There can be no doubt that landlords should raise the *farm buildings*, and the lease tenants would cheerfully keep them in repair; but the repairs in this country are so heavy, that it is not fair to burden the tenant with them entirely. Some tracts are at a great distance from lime, the winds are continually damaging the roofs, the moisture of the air rots the wood, and iron speedily corrodes * if not covered with annual coats of paint. In selecting

---

* "Armoure will not indure in this countrye halfe the tyme it will doe in England; for let armoure be cleaned ever soe well, in one week it will grow rusti."—*Hist. Pembroke,* 1600.

the site for a new homestead, water, shelter, and centricity should be well considered. Barns require to be larger; warm and sheltered yards are wanted for the young cattle; and the numerous well-known conveniences should be built which are requisite for rearing stock, and for successfully carrying on an improved system of agriculture.

The introducers of the new style of farming have frequently pushed their favourite systems too far, " making art to *supersede* instead of *assist* nature." Thus the east of England and the west of Wales are so totally different in soil and climate, that the system which would be best in the one is found nearly impracticable in the other. The new rotation, therefore, when introduced in its purity, exhibits such defects, that the farmer of the old school at once totally rejects it; and the introducer, after many years of trial, will find that, to make it profitable, he must relax some of his original exactness. The Welsh farmer, therefore, should adapt his system of improvements to his own soil and climate, and not to that of Norfolk, or any other totally different portion of the kingdom. The foundation of the old system was not, at the time it was practised, radically wrong, for natural good grass, excellent both in quantity and quality, constituted the chief wealth of Wales. The real evil is caused by the extension of the old system, which, as it now exists, cannot be too strongly condemned, for it is hardly possible to conceive a worse course of cropping. For five years the land produces feeble crops, and for five years it produces nothing, being provincially and appropriately termed " resting." It appears curious that, with a climate particularly adapted for green crops, so few turnips should be grown. A good rotation is the foundation of all farm economy; and till some better course is introduced, the agriculture of Wales cannot improve. Turnips must be extensively cultivated. Wherever they have been tried, and had a fair trial, in good soils or bad, on elevated or low lands, they have invariably succeeded. After land has been once brought under tillage, summer fallows cannot be necessary. If the land requires rest, let it rest *under the shade of the turnip,* instead of *roasting in the sun;* and should it want cleaning, use a little extra force, and prepare it for a green crop, and with a less harassing system of cropping it will never be so difficult to clean again. It is always considered abominable farming to take two white-straw crops in succession; still, with moderately high farming on good soils in this country, that abomination may be successfully practised. Experience has proved that on the better lands, barley, after a *drawn* crop of turnips, will frequently lodge. Even Mr. Morgan, in his Prize Essay on the Cropping of Pembroke, admits " barley on some soils is not a safe crop after turnips." Although the following course cannot be defended on the principles upon which the rotation of crops are founded, yet it is practically found to be one best suited to the good land of this district:—1. *Turnips;* 2. *Wheat;* 3. *Clover;* 4. *Wheat;* 5. *Barley.* Turnips flourish better when supplied with small portions of manure and guano combined, than if dressed only with the same value of each. Hand and horse hoeing cannot be too frequently or too carefully performed, and a portion of the turnips should be consumed on the land by the store sheep. Spring wheat flourishes well in this climate, and has long been cultivated with success. So early as the end of the sixteenth century, the Lord of Kemmes says, " Somer wheat is sowed in the latter ende of March, or beggining of April. It is a profitable grain, and yieldeth more increase than winter wheat." Mr. Davies observes, " Spring wheat seems well adapted to succeed turnips on soils *not below* mediocrity." He also mentions instances of wheat being sown on the 1st of May, and ripening within nine days of barley sown in the same field and at the same time. An intelligent farmer in this neighbourhood last year did not finish sowing his wheat till May, and even with that drenching sunless summer, it was cut in the early part of September, and produced above 32 bushels per acre. There is thus plenty of time to clear the turnips off the land ; but there is an objection urged against growing clover with the spring wheat, as it invariably runs up so high, that when the wheat is cut in the short days of September, the quantity of clover will never die, and it is often found impossible to save the corn. This results from sowing the seed early ; but suppose the wheat to be sown in February, some time in April it may require to be hoed. After that operation let the clover be sown, and a good bush-harrow on wheels, or a light seed-harrow, be used to cover the seed. If hoeing be not required, the harrow will do just as well. There will then be no trouble with clover at harvest ; it will not uselessly expend itself, and there is sure to be a good plant, as wheat seldom lodges, and so grows that it readily admits air to the young seeds. Should the land be required to be laid down for a term of years, the natural grass seeds can be sown with the spring wheat instead of clover. About one-fourth of the land allotted for clover should be sown with rye for spring feed, and vetches for soiling in yards, to be followed by rape, which grows beautifully here. This, fed off by sheep, would be a capital preparation for the wheat-crop, and prevent the too frequent repetition of clover. After wheat and barley, with the natural tendency of the soil to produce couch, and the uncertainty of a sufficiency of dry weather to clean the land for the root-crop, it would be unwise to grow a large quantity of vetches before turnips. Wheat sown on clover-ley is considered liable, in this climate, to be choked with grasses, but using a good plough *with a skim coulter* will materially remedy this. It may be found advisable to plough the land in July, immediately after the hay is carted, and make a bastard fallow for wheat. This will be found useful to eradicate root-weeds; and, with a dressing of lime and manure, will often produce better crops than the ley ground. Barley after wheat often yields more corn, and it is decidedly of better quality; for when barley lodges, as, before observed, it frequently does when following turnips, the grain is light and it readily sprouts, and in addition to this it kills the layer. By far the most profitable course of farming weak and shallow land in this moist climate is, a fallow, *oats and turnips, barley, grass.* Suppose a field of light soil; clean it thoroughly, put it in good heart by lime and dung, and take a crop of turnips. Eat the principal part of these on the land by sheep or cattle; give the field two shallow ploughings, sow the barley thin and seed thick with *white clover* and good *perennial rye-grass.* This land will not only keep, but *feed,* a great quantity of stock, and will continue to do so for a series of years. The time for breaking up will be denoted by its mossing and fogging; and when ploughed, take but one crop of oats, turnips, barley, and then down again as before. Shallow land, when laid down for a course of grass, is often infested with furze and brambles. The plan of burning them, so often resorted to, only increases and strengthens their growth. When the ground is taken up for a ley crop, a boy with a mattock should follow the plough, and tear up deeply all the roots which have escaped the share. As soon as the shoot of the young furze makes its appearance in the grass land, it should be immediately stumped up; and if brambles are cut in a young state, and their branches not allowed to strike root or shed their seed, the increase of the evil will be effectually stopped.

As a simple profit-and-loss statement of the old system has been given, it is only fair that a similar account of this rotation should be here rendered. First, the good land, well farmed:—

Dr. *Cr.*

Year.	Crop.	Rent, Tithes, &c.	Cultivation and Expenses.	Seed.	Lime and Manure.	Outlay.	Produce.	
		s.	*s.*	*s. d.*	*s.*	£. *s. d.*		£. *s. d.*
1	Turnips	26	70	5 0	60	8 1 0	20 tons, at 5*s.*	5 0 0
2	Wheat .	26	30	19 6	..	3 15 6	24 bushels, 6*s.* 6*d.*	7 16 0
3	Clover,&c.	26	16	12 0	..	2 14 0	Clover, hay, &c.	3 10 0
4	Wheat .	26	35	16 3	50	6 7 3	24 bushels, 6*s.* 6*d.*	7 16 0
5	Barley .	26	35	10 6	..	3 11 6	32 do. 3*s.* 6*d.*	5 12 0
					Profit	5 4 9		
						29 14 0		29 14 0

This being a calculation for *five years* only, but half the quantity of lime put on for the old ten-years course is supposed to be used, and that applied to ley wheat. Being drawn out on a precisely similar plan to the other, the straw is not charged, and the manure put at very little, and no interest is calculated for money invested. It would be foolish totally to disregard the peculiarities of some soils, and to dictate this or the other rotation for all the soils of this variable district. If the land naturally favours barley, let the chief produce be barley; and if the upland tracts will not produce that delicate grain, oats must be sown instead. But turnips will flourish anywhere; only let the principle of green crops be established, and it is very easy to modify rotations to suit the peculiarities of any district.

The moisture of the climate of South Wales will always render the rearing of cattle a principal object. Already it is a country celebrated for its fresh springing grass, and it will soon, it is hoped, be distinguished by its root and green crops. Whenever ley ground is taken up for a course of tillage, let the serious loss that is now sustained by the poor pasturage of over-cropped land suggest the important fact that, in returning land to profitable grass, it must be laid down in a dry, clean, and highly manured state.

The Dr. and Cr. account of the shallow land, well managed, is (by the experience of a large farmer) thus rendered :—

Dr. *Cr.*

Year.	Crops.	Rent, Tithes, &c.	Cultivation and Expenses.	Muck and Lime.	Seed.	Outlay.	Produce.	
		s.	*s.*	*s.*	*s.* *d.*	£. *s.* *d.*		£. *s.* *d.*
1	Oats . .	12	25	. .	8 0	2 5 0	32 bush. at 2*s.* 3*d.*	3 12 0
2	Turnips	12	70	75	5 0	8 2 0	15 tons, 5*s.* .	3 15 0
3	Barley .	12	30	. .	8 6	2 10 6	32 bushels, 3*s.* 3*d.*	5 4 0
4	Grass .	12	4	. .	12 0	1 8 0	Grass (pastured)	2 10 0
5	Do. .	12	4	. .	. .	0 16 0	Do.	2 5 0
6	Do. .	12	4	. .	. .	0 16 0	Do.	2 0 0
7	Do. .	12	4	. .	. .	0 16 0	Do.	1 15 0
8	Do. .	12	4	. .	. .	0 16 0	Do.	1 10 0
9	Do. .	12	4	. .	. .	0 16 0	Do.	1 5 0
10	Do. .	12	4	. .	. .	0 16 0	Do.	1 0 0
				Profit 10 yrs.		5 14 6		
						24 16 0		24 16 0

It will be found very advantageous, in rearing *cattle*, to give the calves new milk longer than is now allowed ; and when skimmed milk is substituted, a little linseed porridge should be added. It is necessary to the health of calves to keep them in warm, fresh, roomy cribs, where they can enjoy plenty of exercise. The yearlings in winter do best in a well-shedded strawyard, with a good supply of hay and turnips; and the older cattle in similar yards, with turnips and fresh oat or barley straw. The cows should lodge within during the night, and be supplied with hay, of which they could have more were turnips generally grown and the young stock fed on them. But provided there are, unfortunately, *no buildings,* that only increases the necessity of growing turnips. If cattle cannot be *warmly kept* they *must* be *well fed,* or they will make no progress, as is often the case now throughout the winter. Turnips may be thrown on a pasture, and the young stock will thrive well there. Convenient farm-buildings would much improve the grass lands of the country. Many meadows are now poached and puddled, to their great detriment, throughout the winter; and by the cattle continually gnawing every young blade of grass the moment it appears, the spring feed is made so late —backwarder than in England. In the selection of breeding-stock it should be remembered that a bull ought to possess other qualities as well as that of a sure stock-getter; and that although it is very desirable for a cow to be a good milker, there are other most important characteristics to be considered. By endeavouring to remedy those points where the breed is naturally deficient, the Pembroke cattle will, in an eminent degree, display the valuable combination of milking and feeding qualities. Giving the young stock proper exercise, warmth, and nourishing food, will soon show that they are not such slow feeders at an early age as is generally supposed.

Sheep when very young may be successfully house-fed on turnips and hay, and of course the addition of oil-cake and corn will greatly assist. All long-woolled lambs are best shorn; and those that are intended for the house should be taken in about October, separated into small lots, and kept clean and well ventilated. From March to May, when good mutton is generally scarce, house-fed sheep will sell with profit. Sheep will not progress so rapidly when exposed to the incessant rains of the winter, neither will they bear in this climate the hard folding that is practised in England. The farmer of the enclosed lands might gradually supplant his present mixed bred ewes with good hardy Downs, and advantageously cross them with a Leicester or Cotswold ram. The produce would be admirably adapted for early feeding; and there is ample opportunity to purchase Downs from those gentlemen and farmers who, with much trouble and expense, have imported from England flocks of the very best description. Nothing can exceed the profit of selling all stock reared on the farm, *fat.* Thus a gentleman and practical farmer, whose occupation rests upon a barren tract of the Pembroke coal measures, stall-feeds all his cattle at two years old; his sheep (which are house-fed) are sold at thirteen or fourteen months, and pigs at six or nine months old. No artificial food is consumed; the stock is the ordinary produce of the country, yet the amount of meat and dairy produce that is returned on a small invested capital is astonishing. It will be replied to this, that the markets are now so limited that this system can only be practised by a few. This is lamentably true; but when the South Wales Railroad is finished it will open the mining districts to the Western counties, and enable the Welsh farmer to dispose of his stock in the English markets. This gentleman prefers to keep *farm-horses* by pairs in loose boxes, with a small yard attached. There is a trough for water, and a bin for green food in summer in the yard, while the box is supplied with a rack to contain the bruised gorse, and two separate mangers, that the horses may be tied up when feeding and not devour each other's corn. Horses when at work on the farm are sometimes exposed to cutting winds, &c., and when thus treated are not so subject to colds and sore-throats as those kept in stables. They also appear to rest with more ease than when tied up in a stall. The horses are kept in the entire year, and thus all the manure is saved. When turned out to grass, horses feed it very unevenly, and spoil much of the grass if long. During the winter the gorse (which will last four months) is cut into chaff, and, with one bushel of oats and a few swedes horses are kept in capital condition. In March, as the busy season advances, hay is substituted and the corn increased. Vetches will come to hand in May, and will, with clover, last till the gorse is ready in the autumn. The tender shoot of the young furze is admitted to be both "palatable and nutritious;" cheapness is certainly added to these good qualities. The gorse is best when cultivated; but the great quantity of land which produces nothing else, causes the Welsh farmer to prefer gathering it from the natural plants. By this method of feeding little hay is consumed, and it is desirable, especially in the upland tracts, not to place much reliance upon the hay, as it is generally badly saved and of inferior quality. For breeding, the best and youngest mares should be selected, and the colts sheltered and well fed during the first two winters.

The lack of accommodation will not allow the Welsh farmer to resort to the improved methods of making *manure*, therefore some suggestions are thrown out that may be of service in his present condition. After the manure is carted to the fallow in the summer, it would be well to line "the court" with sand, ashes, or some porous material, to the depth of 3 or 4 inches. This would absorb much of the urine, which, from the cow, constitutes the most valuable part of the manure. Instead of having the drain from "the court" run into the horse-pond, it might flow into some mould or peat, which should be collected for the purpose, and now and then turned. All the cleaning of the stables and hovels should be carefully spread, and the straw for the cows not placed in heaps, but in bins, which can be roughly constructed at very little expense. These bins should be constantly shifted, so that all the manure will receive an equal pressure. The droppings of the young cattle, often met with in large quantities under the pasture-fences, might be collected and spread about the court, which would increase the amount of animal excrement so much wanted, as most frequently the common manure is not much more than rotten straw. It is not recommended, even for light and porous soils, to turn manure heaps more than once. Every practical farmer knows (and chemistry confirms our experience) "that farm-yard manure begins to lose its most valuable properties as soon as ever fermentation commences." When manure is carted very early in the season, it should be placed upon a bottom composed of earth not less than six inches deep. Of course the carts should be drawn over the heap, and all carefully spread. The manure cannot be too well mixed; and that from the fat cattle, the cows, and the horses should be placed in alternate layers. When the heap is completed it should be well covered with ashes, road-scrapings, or any mould, and thus no evaporation or fermentation will take place. For all soils it should not be turned over more than a fortnight before required for use, and then well cased with the mould that was below. When dung late in the season is required for immediate use, should the yards not be wanted, it can be packed up there in a heap, covered with the earth's lining before recommended, and it will be ready to be applied to the land in about ten days. In both cases fermentation will then have taken place, sufficiently to kill the seeds of weeds and the larvæ of insects,* without losing any quantity of ammonia. Experiments have proved that plants flourish most luxuriantly when exposed to the influence of matter disengaged by fermentation. Although it may be contended that well rotted dung is more soluble, and therefore more easily taken up by the young turnip, persons of a contrary opinion think that the gases given off by the fermentation of manure in the soil are more easily applied to the wants of the infant plant. At any rate, by repeated turnings this is all lost, and there can be no doubt that well rotted manure is not so lasting in its effects as the other.

One of the evils of the *life leases* is the large amount of capital the tenant sets fast on his entry by building, &c.; and another is felt by the landlord, who finds it impossible to rid his estate of a slovenly or bad farmer. But a tenant farming from year to year cannot be expected to improve permanently the property he hires: he neglects to expend his capital, lest good crops should bring increased rent or loss of the occupation. If there is an objection

---

* In addition to grubs, the egg of the wheat-midge and other insects that prey upon the cereal crops are deposited in the husk and straw of corn, and will therefore, it is supposed, be destroyed by fermentation.

to grant a *lease for lives,* one for a limited number of years might be substituted, having a *compensation clause for improvements.* An unskilful farmer without capital would not be then a clog for so many years, and there would be ample security for the money expended by the enterprising tenant. All leases should contain clauses prohibiting the occupier from taking *more* than two white-straw crops in succession, and making it compulsory that all manure, hay, and turnips should be left at the expiration of the term; the two last to be taken at a valuation by the in-coming tenant. The new comer also to pay for the threshing of the crop, and receive the straw in return.

Provided the land was properly cultivated, there would be a very scanty supply of *labourers,* and consequently the poor man would receive better wages. This would soon improve his moral and physical condition. He would be enabled to procure more nourishing food, and the common necessaries of life for himself and family; then he could perform his daily labour with more ease to himself and satisfaction to his employer. By better food, it is not meant that the best wheaten bread is essential for the hard-working man. The poor of Scotland, who never see any flour diet, are an industrious and healthy race. As it is now admitted that education should be adopted to suit the probable employment of after-life, surely it would conduce much to the comfort of the labouring community if, in our National Schools, where the peasant girls are educated, some brief outline of the first principles of practical *Domestic Economy* were taught; for the wife of a poor man should know how to dispose of and manage his small weekly wages with the greatest advantage!

The best way for an enterprising landlord, in the Welsh parts, to disseminate improved and scientific agriculture among his dependent farmers would be, to encourage the education of the most intelligent of his tenants' sons—to place them in the Royal Agricultural College—to permit him to view various good farming in England and Scotland, and then take him as his farm-bailiff. His practical and theoretical knowledge could be easily explained to the unlearned and unskilful tenantry, and might convince those who, from real ignorance, are often considered obstinate. The Welsh have, moreover, a dislike to anything propounded by strangers; and new practices of husbandry are rarely popular unless introduced by natives of the country. The very remote position of the country and the Welsh language much retard agricultural improvement. It is curious, that wherever English is spoken the farming is very superior, and has much progressed of late, whereas in the Welsh parts little improvement can be traced. On the other hand it may be said, the Saxons and Flemings of old selected the most fertile and easily cultivated land for their settlements, and therefore all the best and level spots are occupied by their descendants. But few of the Welsh have the chance of witnessing and seeing the effects of good farming, and the language forbids them to wander out of their district in search of practical information, and the Englishman, who would introduce improvements, finds that the strange tongue presents an insurmountable obstacle to his laudable effort.

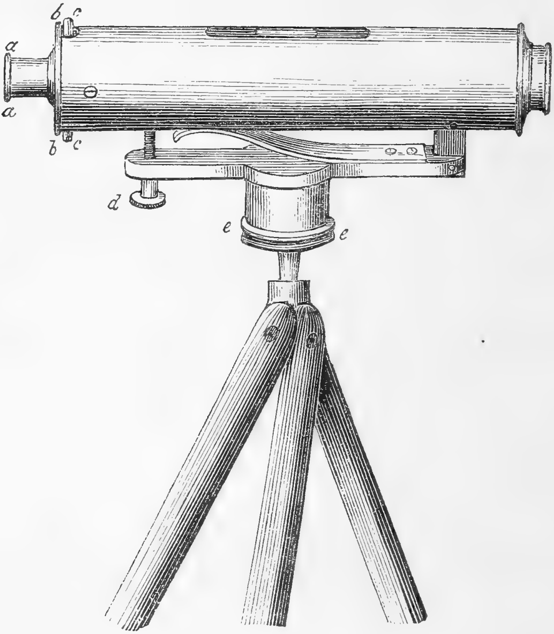
The various defects of the agricultural management of South Wales have been plainly, but, it is hoped, fairly stated; and they are laid bare with a sincere desire to arouse attention and quicken improvement. The principal permanent improvements require a vast outlay of capital, and, with the present low price of all agricultural produce, there is little inducement, either for the landlord or tenant, to embark money with so poor a prospect of remuneration; still, if *good* farming is not very *profitable*, a *bad* system is a *certain loss;* and all must strive "to produce the most at the least cost." But it should be particularly remembered in Wales, that a system of cropping must be adopted which, instead of *injuring*, will *improve* the soil. Then may the Welsh farmer hope to overcome the natural obstacles which now impede his progress, and place the hitherto neglected agriculture of his country on a level with the improved districts of England.

P.S.—I have to offer my warmest thanks and best acknowledgments for the kind assistance I have received from the following gentlemen, who (among others) have obligingly furnished me with various and important particulars of the farming in their respective localities, viz.—Mr. Evan Williams, near Brecon; Mr. E. W. David, Cardiff; Mr. Wm. Edmond, Swansea; Mr. Geo. Goode, Carmarthen; W. H. Lewis, Esq., Cardigan; and Mr. Isaac Williamson, Pembroke.

VII.—*Description and Use of an Improved Agricultural Drainage Level, with the Process of Levelling, as required for Agricultural Purposes.* By T. Cooke, Optician and Mathematical Instrument Maker, York.

The process of levelling, even for agricultural purposes, is one that has been generally considered to require a complicated and costly instrument, and difficult to use; in consequence, many draining operations have been attempted without the aid of an instrument for taking levels, and frequently, as might have been expected, much useless labour and expense have been incurred, before the object attempted was satisfactorily attained.

The New Drainage Level has been constructed for the use of the Farmer, the Land Steward, and persons superintending Drainage operations, on a cheap, simple, and efficient principle. It may be carried in the pocket, and is not at all liable to get out of order. Its use may be readily acquired by any ordinary workman, and in the hands of a person who has had a little practice with it, it is capable of showing the difference of level between two places, however distant, with great accuracy.



The Level is represented in the preceding figure, and consists of an achromatic telescope, with cross lines, which gives the instrument a great advantage over all those constructed with plain sights only, as a staff painted white, and divided by black lines into inches, can be read distinctly at the distance of 80 or 100 yards.

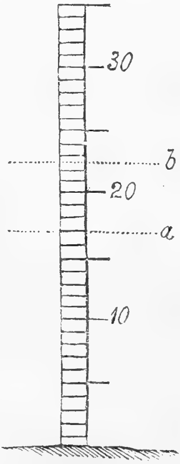
The telescope tube is made rather wide, to admit the spirit tube, without interfering with the vision, being placed inside, for greater protection; the bubble of which is seen through an opening in the upper part of the telescope.

There is a bar placed under the telescope and attached to it by a joint at one end and a screw at the other; with this screw the telescope and bubble are accurately adjusted to the horizontal position. In the centre of this bar is a universal joint that will allow the telescope to be turned in any direction, and at this joint the level is fixed to the tripod stand, which is one of a very simple and firm construction.

The method of adjusting the Instrument, and reading the Staff.—First place the level on the stand and direct a person to hold a graduated staff perpendicularly at a convenient distance, say 50 yards. Direct the telescope to the staff, draw out the eyepiece a little by the edge *a a*, till the cross lines are seen clearly, then draw out the telescope tube by the edge *b b*, till the divisions on the staff are also clearly seen.

Move your eye a little up and down while looking through the telescope, and if the horizontal line seems to flit or move amongst the divisions on the staff, slide the telescope tube a little in and out by the edge *b b*, till the horizontal line, while the eye is being moved up and down, seems fixed upon one part or division of the staff: if, by doing this, the divisions on the staff have become a little indistinct, slide the eyepiece *a a* a little in or out, till the divisions again appear distinct. This latter operation is termed correcting the telescope for parallax, is a very easy one, and is very necessary to be carefully done where accuracy is required.

Move the telescope on the universal joint till the staff appears between the two vertical lines and *parallel* to them; at the same time put the telescope as nearly into the horizontal position as possible, then with the screw *d* bring the spirit bubble exactly into the middle of the opening.



The instrument is now correctly adjusted, and while in this position the reading of the staff should be taken.

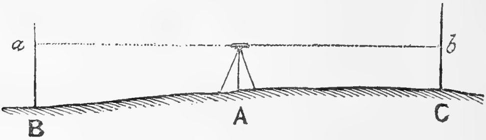
The telescope inverts objects, but any difficulty from this, to a person unaccustomed to such a telescope, will be easily removed by considering the divisions must be read in the direction in which they are numbered, or apparently downwards.

Thus if the horizontal line in the telescope appears to cut the staff at *a*, the reading is 17 inches; if at *b*, it is 22½ inches, &c.

If the level move too stiffly or too easily on the universal joint, it must be altered with the milled screw, *e e*.

Levelling, as required for Agricultural Purposes.—Levelling is the art of finding a line parallel to the horizon at one or more stations, to determine the height or depth of one place with respect to another.

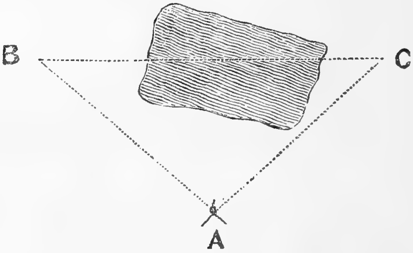
To find the difference of level between two places, when the distance does not exceed 200 *yards.*



First place your instrument at A, midway between the two places B and C, and direct your assistant to hold the staff *perpendicular* at B; then point the telescope to it, adjust the instrument and read off the staff as directed above. Suppose the reading 67½ inches; your assistant must now take the staff to station C; turn the level round on the joint, *taking care not to remove the stand*, direct the telescope to the staff, adjust and read as before. Suppose this 52 inches.

The difference of the two readings is 15½ inches, which shows that the ground at B is 15½ inches lower than at C.

If the line of sight or of collimation of the telescope is known to be correct (see pages 171, 172), it is not of so much importance that the Instrument be placed so exactly midway between the two stations, though it is always better to place it so when practicable.



If there should be buildings or other objects between the two stations, place the Instrument on one side as at A, where you can get a view of both stations, and the difference of the readings will give the difference of level as in the previous example.

When the distance of the two places, the difference of level of which is required, is considerable, a series of observations will be necessary.

In this case divide the distance into portions of 100 or 150 yards each, or into unequal portions as circumstances require, and drive short stakes into the ground at each station, even with the surface, upon which to place the staff. Then put up your instrument midway between the first and second stations, your assistant holding the staff upon the first, which call the *back station;* adjust your instrument and take the reading, then direct your assistant with the staff to the second or *front station,* turn your instrument round on the joint, adjust and read off as before.

After which remove the instrument to midway between the second and third stations; the second station now becoming the *back station,* and the third the *front;* adjust the instrument and read off the staff at both stations as before, and thus go on from station to station until the whole set of observations necessary between the two extreme stations is completed.

The following example shows the form of Levelling Book, and the method of reducing the observations :—

No. of Stations.		Distance between Stations.	Back Stations.	Front Stations.	Rise.	Fall.	Height of each Station above datum line.	Quantity deduct for Fall.	Depth of Drain at each Station.	No. of Station.
Back.	Front.	Yds.	Inch.	Inch.	Inch.	Inch.	Inch.		Inch.	
							40		40	1
1	2	90	64	52	12		52	7	45	2
2	3	100	73	45	28		80	15	65	3
3	4	80	69	51	18		98	21½	76½	4
4	5	90	57	71		14	84	28½	55½	5
5	6	95	52	76		24	60	36	24	6
		455	315	295	58	38				
			295		38					
		Rise	20		20					

The first column contains the numbers of the back and front stations.

The second—The distance between the stations, in paces, yards, or chains.

The third—The readings of the *back stations.*

The fourth—The readings of the *front stations.*

The fifth—The rise from the back to the front station obtained by subtracting the *front* reading from the *back* reading.

Sixth—The fall from back to front station, obtained by subtracting back reading from front reading.

Seventh—Gives the height of ground at each station above *datum,* or a horizontal line passing through the bottom or the lowest part of the drain at outlet.

This column begins with the number of inches the depth or bottom of outlet of drain is, below surface of ground at first station. In the example it is 40 inches. The numbers in column fifth are added to, and those in column sixth subtracted from the number at top of column seventh, as they succeed each other in the two columns.

Eighth—Contains the inches to be deducted from the inches opposite in column seventh, that the drain may have an even and uniform fall from its highest part to the outlet. These numbers are obtained thus:—Add together the numbers in column second, the sum is the whole length of the drain. Decide upon the fall the drain should have for that length, or upon as much as circumstances will allow. In this example it is made 36 inches, which is put the bottom number in the column. For the number for each of the other stations multiply the distance of the station from the first station or outlet by the inches of fall in the whole length of the drain, and divide the product by the whole length: the quotient will be the fall for that station.

Thus for the fourth station.

```
                   270 yards.  distance from outlet.
                    36 inches.  fall in the whole length.
                  -----
                  1620
                  810
                  -----
Length 455 yards )9720( 21½ inches fall from station fourth.
                  910
                  ---
                   620
                   455
                   ---
                   165
                   ---
```

Ninth—Contains the inches the depth for the drain from surface of ground at each station, obtained by subtracting each of the numbers in column eighth from that in the same line in column seventh.

Tenth.—The number of the stations.

In the figure annexed, A is the bottom of drain at outlet. A B the horizontal datum line. A 1, *b* 2, *d* 3, *f* 4, *h* 5, B 6, are the depths given in inches in column seventh. *ab*, *cd*, *ef*, *gh*, C B, are the depths given in inches in column eighth. A 1, *a* 2, *c* 3, *e* 4, *g* 5, C 6, are the depths for the drain at the different stations given in inches in column ninth.

The line A C represents the bottom of the drain.

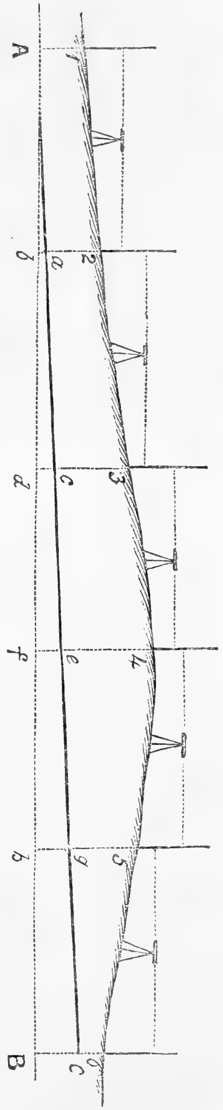
As a check to the calculations, the difference of the sums of columns third and fourth should be the same as that of columns fifth and sixth, as should also the difference of top and bottom number of column seventh.

If the difference of level between two places is merely wanted for the purpose of ascertaining whether draining be practicable or not, the Level Book need only contain the two columns, third and fourth, the difference of whose sums will be the difference of level of the two places. No distances need be measured. If, after this trial is made, draining is ascertained to be practicable, determine the best position and direction for the projected drain, then begin at the outlet and take a new set of observations, proceeding as in the preceding example.

It is recommended that the levelling staff be divided into inches and numbered as such ; it is more convenient for calculation. The final results can readily be reduced to feet if necessary.

To adjust the line of sight, or Collimation of the Telescope.—The line of collimation is a line passing through the centre of the object glass and the middle of the horizontal line near the eye end.

This line of sight should be parallel to the horizon, when the spirit bubble rests in the centre of the opening. To ascertain this, select a piece of ground as nearly level as you can find, drive in two short stakes even with the surface, at the distance of about 60 yards from each other.



Place the level exactly in the middle between the two B. C., adjust it carefully, and read off the staff at both the stations, as directed in the first example of levelling. Suppose the reading at B, 60 at C, 58½ inches, the difference is 1½ inches which C is higher than B. Remove the level to B, and place it so that the object end is directly over the stake, point the telescope to the staff on C, and adjust the spirit bubble carefully to the centre of the opening, then measure the height of centre of object glass above B, which suppose 58 inches ; read off the staff on C, which, as C is higher than B by 1½ inches, if the collimation is correct, will be 56½ inches. If the reading is more, the line of sight points too high, if less, too low. If too high, unscrew the lower screw *c* of the level, and screw in the upper one *c*. The contrary when the line of sight points too low; move the screws only a little at a time, and take care not to force them too tight. Repeat this until the horizontal line of the telescope intersects the staff at the proper place; in this example, at 56½ inches.

Another method to make this adjustment is by means of a sheet of water, which, when it can be come at sufficiently large, is convenient and accurate. At the distance of about 40 yards, drive two stakes close to the water's edge, till the upper ends are even with the surface of the water; fix the level over one of the stakes, and the staff perpendicularly upon the other; adjust the instrument for reading the staff, then measure the height of centre of object glass above the stake over which it is placed. If the reading of the staff is not the same, make it so, by moving the horizontal line up or down by the collimation screws, *c c*.

This is an adjustment, when once well made, that seldom requires repeating.

The Levelling Staff—to accompany the level, is made of mahogany, well seasoned; light and portable. Its length when closed is five feet, when drawn out, 9½ feet. It is divided into inches by strong black lines, upon a white ground, which can be easily read through the telescope of the level, at the distance of 100 yards.

Price of the new Drainage Level improved, with book of instructions for using it, 3l. 5s.—Price of Staff, above described, 15*s.*

VIII.—*On Hemp.* By Thomas Rowlandson.

Hemp (*Cannabis Sativa* of Linnæus) belongs to the same order of plants (*Diœcia Pentandria*) as the well-known plant which grows on dry ditch and hedgerow sides—the common stinging-nettle, which in outward appearance it greatly resembles. The common nettle has repeatedly been used economically in the manufacture of textile fabrics.

The soil best suited to the growth of hemp is a deep, rich, alluvial, and moist, mellow mould; one in which well-decomposed vegetable matter is mixed with alluvium composed of fine clay and sand, and intimately mixed, I have found the best adapted to its cultivation. Rich old pasture land fresh broken up, if not too stiff, is the soil on which hemp particularly luxuriates. On such pastures being broken up, which may be deemed too rich for flax, and on which the cereals would run too much to straw, hemp can be grown with the greatest advantage. Hemp is a plant of exceedingly rapid growth when grown under favourable circumstances, and frequently obtains a height of 6, sometimes 7 feet. It is said, however, that in Italy, and the warm Oriental climates, to attain sometimes a height equal to 15 or 18 feet, without any diminution of the equal texture and fineness of its fibre. The time for sowing hemp should never be earlier than the 15th of April. This, however, will greatly depend upon the character of the season, and general climate of the place where it is intended to sow hemp. Many persons prefer the first week in May. The latter, according to my own experience, I have always found the best suited; as hemp is a most unprofitable crop, unless it is grown on such a rich soil as will force it rapidly forward. It is better, therefore, to wait a short time for more genial weather than to run the risk of the crop being destroyed by a spring frost; as hemp, from its eastern origin, is peculiarly obnoxious to the destructive effects of frost while in its earlier stages of growth.

The quantity of seed to be sown per acre must, according to circumstances, be regulated from 2 to 2½ bushels per acre. If, however, a very fine fibre is desired, suitable for manufacturing a coarse species of cloth similar to those manufactured from coarse flax, 3 bushels may be sown with advantage. On very rich soils, however, this should never be attempted, and the larger quantity can only be sown profitably on soil of second rate, but at the same time, of good quality. At the time the hemp is coming up, care must be taken to scare away small birds, otherwise they will make tremendous havoc with the cultivator's future prospects. This care will also have to be borne in mind at the time of harvest, if the female plant is allowed to stand for seed. There are some very rich pasture lands, which on first breaking up will yield an excellent crop of hemp without any manure; the generality will, however, require a dressing of 10 tons of well-rotten farm-yard dung per acre. If the cultivation of hemp is carried on with land that has been previously broken up, the general practice has been with the cultivators of that article to plough up the stubbles in autumn, and carry on to the land manure, 20 tons at least, during the winter; a practice, in my opinion, reprehensible, whether for hemp or any other crop. I have made small comparative trials between this method and carting well-rotten manure on to the land, ploughing and harrowing it in early in April, and I have found the advantages greatly preponderate in favour of the latter method, both in economy of manure and amount of crop. It must, however, always be borne in mind that the manure carted on in spring should be well rotted, as hemp, being a quick-growing plant, requires its nourishment (manure) to be well prepared, the time of occupying the land not being sufficient to permit its perfect but slow decomposition. Night-soil exceeds all other manures in promoting the luxuriant growth of hemp; and if applied in abundance will make hemp grow on any porous soil, provided it is sufficiently retentive of moisture during the heats of summer.

In consequence of the peculiar nature of hemp, differing as it does from all our other ordinarily cultivated plants in having the male and female flowers on separate plants, the harvesting of hemp has some peculiarities. In taking the hemp crop, two methods are followed, according as the object in view be either to obtain a fine fibre adapted to the manufacture of cloth, at the sacrifice of the seed; or the fibre and seed conjointly. In the former case, a crop of turnips or rape, to be eaten by sheep, may be obtained after gathering the hemp.

When the crop is grown entirely for the fibre, it is pulled while in flower, and no distinction made between the male and female hemp plants; but it is generally grown on account of both fibre and seed, in which case the usual practice is to pull the male plants as soon as the shedding of their pollen has effected the fecundation of the female. The pulling is effected in the following manner: the pullers walk in the furrows, between the ridges, and reach across to the crown of the ridge, gathering a stalk or two at a time. At this time the male stalks are easily known by their yellowish colour and faded flowers. In this operation the treading down of the female plants must be carefully avoided. The pulling of the female plants commences when the seed is ripe, which is known by the colour of the capsules turning to a brownish or greyish hue, and also by the fading leaves. I had proceeded thus far on this subject when I received a communication from a person to whom I had written for additional information on the subject, and from whom I received the following valuable letter. I may mention that all my experiments were conducted under the direction of the person to whom I now allude, who received a medal for his excellent culture and subsequent management of the fibre, at the period (during the late war) when a considerable quantity of hemp was grown, and consequently considerable competition existed. I may mention that he is a native of Lincolnshire, and that his remarks apply principally as regards culture to the soil and climate of that county. His remarks about the preparation of the fibre are of peculiar value, as I would with safety challenge his management and manual dexterity in this respect against all England as regards hemp and flax—I might perhaps challenge with safety the world. I give his communication entire, as I deem it too valuable to be mutilated, and it would be difficult to select and re-arrange the matter without in some degree destroying a portion of its value. He informs me in a subsequent letter that it was a common practice during the war to give with pupils 150*l.* to 200*l.* to a known good hemp farmer as a fee for teaching the mode. His experience—which, as he justly remarks, has cost him a considerable sum of money and much hard labour—is as follows:—"The soil best suited for this plant is a fat, strong mould, from 5 to 6 inches deep, and light clay loam is particularly suited. Care must be taken that the land is not over-heavy clay, as in the event of sowing such land with hemp it would not be possible to pull it; for, when strong clay becomes saturated with rain, the soil runs together, and on drying sets as hard as a pavement. *All* soils suitable for the growth of hemp contain a fair portion of sand, the sand keeping the soil open and light, for the roots of the plant to work for its food. Sandy and bog land were cultivated for hemp, during the long-continued wars, in the neighbourhood of Crowland and Spalding; but was gradually discontinued before its conclusion, or nearly so, producing a very inferior article, that obtained a low price. The best mode of cultivating hemp, according to my experience, is as follows:—When the farmer has selected the portion of land which he intends sowing with hemp, he should plough it in November, and lay it up in about six yard ridges, so that it may mellow during the frosts. Care must be taken to plough the land 6 inches deep, if the soil will allow that depth, without interfering with the subsoil. This must be particularly attended to, as, if the subsoil is clayey or too much sand, and any be turned up, it will make the soil poor. The land must be well and properly drained, and the water-courses particularly attended to, and the furrows well opened in all parts of the land where water would be likely to remain *at any period* of the year; as wherever water has remained on the land at any time, there the hemp will be good for nothing. Early in March the land must be cross-ploughed if the weather is dry, and lie in that state until the beginning of April. The drainage must be attended to;* as in a great number of seasons heavy rains fall in April and May, which if the water is left to lodge on the land, especially at that season of the year, makes the land cold and sad, and the hemp will be of little or no value. The land having been attended to as just mentioned, it must be well harrowed in dry weather (the roller passed over it), and harrowed up again, and cleared of all roots and twitch. Twitch and horse-mint are fatal to the growth of hemp. The roller and harrow must be applied as often as is found necessary to get the top-soil into fine tilth: then the land may be allowed to lie in that state for a few days, to dry up the small pieces of roots that remain ungathered, and the weeds will sprout. When this portion of the management has been effected, the land must be ploughed, the same way of the field it is intended

---

* At the period alluded to, 1810 to 1815, superficial drainage was mainly adopted in the low lands of Lincolnshire, which in fact, from their position, will always occupy a farmer's constant attention, and accounts for the reiterated cautions respecting drainage.

to remain; the sets may be laid out 6 to 8 yards wide. Attention must be paid to any plots where horse-mint or twitch had existed, which should be ploughed rather deeper, to raise the roots from the sole, otherwise the top culture will be of little avail. The last ploughing (unless the land has been very foul) will finish the tilth; the roller and harrow must be applied again, and the roots got off, if such is the case, as often as will be found necessary to get the top-soil into good tilth. The month of April will be now advancing, by which time the farmer, if a man of business, will have his manure prepared; 25 tons of which, well rotted, mixed stable and feeding-shed manure, should be applied per acre. Care must be taken to lay the manure on heavier where the land has been impoverished by twitch, horse-mint, or other deteriorating weeds. I have applied yard-manure to rather stiff land with good success. By the preceding arrangement I calculate the cultivator will have from the 1st of May to the 12th of May to cart his manure and plough the land for seed. The manure must be carefully and evenly spread on the side of the field intended to be ploughed first, the plough following close to the spreader. The cultivator of hemp must direct the spreader of the manure to throw out half the heap next to the ploughman first, and then turn down the other half. Long dry days dry the manure up until it is of little value, if allowed to remain exposed to the sun and wind. The hemp-grower must be careful to direct his ploughman to cut a furrow not more than 6 inches, as hemp requires as many seams as possible for the seed to fall in along with the manure. I ought to have mentioned prior to this, that the cultivator should have carefully selected his seed, in doing so he must attentively follow the succeeding directions:—The bulk should be of a bright grey colour and bold appearance; he must take care that it has not been heated in the heap in the warehouse. He may discover this by biting it between his teeth: if the taste is perfectly sweet, and the external appearance as above-described, he may rely on its goodness; if the taste is bitter, it will be found worthless. An acre of land requires 3 bushels of seed; if the hemp is required to manufacture into linen, 2 pecks more must be added. The thicker it is on the land the finer and more slender it will grow. The most approved practice of sowing is to sow the fresh-ploughed land up every evening, and harrow the seed in well with light harrows. If during this the land rises full of clods through carting the manure, it will be advisable to run a light roller over that portion where the clods rise, and leave the land to be harrowed up again after the roller. The best season for sowing hemp is from the 1st to the 12th of May; a few days later *must do* if the weather is wet. On sowing later than the 12th of May the fibre grows thin and weak. As the sowing is proceeded with, what surface drains require to be opened must be done immediately. As the seeds sprout very quick, it is useless and worthless to sow hemp on land other than in very high tilth."

The pulling of hemp was well understood at the breaking up of the late war; since then it has been very little cultivated; it has now become a new article of agriculture. When hemp is sown previous to the 12th of May, it is fit to pull for "white" (or linen) purposes early after the 12th of August; previous to that time the fibre *has not set*, nor has the male stem shed its pollen. It was a practice many years ago, when white hemp ruled high, to pull the weak plants, and all the male stems immediately after the pollen was shed, and leave the female stems to stand for seed. This labour was all performed by women and old men; the price of pulling 100 gleans (as they were termed) was 1*s.* or 1*s.* 2*d.* per hundred of six score. After the hemp was thus pulled, and tied round the head with four or five of its own stalks, it was laid down in rows with the root part spread out; a man must go round in the evening with a boy or woman to set it up in stooks of five or six gleans, the boy taking a fork such as farmers generally use to knock and shake out the soil from the roots, and scrape out the undergrowth that lies in the bottom of the stems; in the course of a few days it will be ready to take to the water; before doing so, it will require tying near the roots, with a band of twisted leaf reed, cut two or three days previously in order to soften, the gleans must then be jumped on the ground to level the roots. When the hemp is carried to the water, care must be taken that the tops of the hemp hang well over the sides in order to cover the stems well; if the sods touch the stems at the sides, it turns the fibre black; the sods with which it is necessary to cover the hemp whilst in the water are generally cut at the side or as near as possible to the water, and are usually replaced when done with. The sods are sometimes cut with a rip-and-sod spade; sometimes with a paring-plough, and then cut into short lengths by the spade. Great attention has to be paid to the process of watering or retting, as it is a most important one. After laying the sods over the hemp they must be trod upon frequently, to sink them and make the water appear between the sods; care must be taken that the roots of the hemp are put the lowest in the water; the treading must be repeated every day until the hemp is ready to be taken out of the water, which will be from nine to ten days if the weather is warm, and rather longer if the weather is cold. This requires considerable skill and experience before a person becomes a thorough judge on the point; the following rules will, however, if strictly followed, answer the purposes of a novice, and, if strictly adhered to, he cannot go far wrong. Let him, when he thinks the retting has gone far enough, take out of the water a glean from the middle, from which take out a stem, then hold the stem by the root end, and draw the thumb-nail up the stem to the top; if the fibre slip up the stem, it will be sufficiently retted; if not, it will require another day, or perhaps more; also spread the glean on its side on the land to dry, it will do so in the course of the day; if the stem then breaks freely, and the fibre leaves it easily, it will have got a good ret, as it is called. When thus far finished, the sods must be taken off, and two men will be required to take out the gleans; one to lift them partly out of the water with a fork, root first; the other taking them from him with a fork; and thus, with the assistance of the bottom man, the gleans are lifted on to the ground, and form a couch, and so proceed until finished. The next day, as if suffered to remain longer in the couch it heats and rots immediately, it is carted out, care being taken that it is laid straight in the cart and taken to grass-land that has been mown and the hay taken therefrom for some time, so that a considerable quantity of new grass or eddish may have grown, in which case the worms do not take in the fibre so much.* After it is laid out on the eddish it should be spread by women very evenly in rows, at 1*s.* 6*d.* per day and their diet with beer. The hemp will require to lie on the eddish perhaps three weeks or more to bleach and the fibre to get free; it will require turning over with a light long pole, putting the pole underneath the top part and lifting it over; this must be done very evenly every three or four days: this labour is done by women.

To ascertain when it has lain long enough on the grass to bleach, the cultivator must after ten days or less, if there have been heavy dews, examine the stems in different parts of the field; and if he discovers any pink spots on the stems, it will be sufficiently bleached, if not it must lie longer; there is no fear of the fibre deteriorating until the pink spots appear: that perhaps by frequent turning may be three weeks; the hemp must then be gathered and tied into bundles, and set up in stooks to dry (the stooks consisting of ten or twelve bundles each), and tied from the middle bundle of each side to each end, to keep the wind from blowing it over. When perfectly dry, it must be carried from the field and placed in a barn or ricked in some exposed part with cullis-roof, where it will keep dry. The scutching has next to be

---

* When hemp is spread on summer-eaten grass-land, the worms will draw a considerable quantity of the fibre into their holes; there requires a good portion of grass after mowing to prevent them (the worms) from so doing;—the stumps and new grass prevent the worms destroying the fibre, provided proper attention is paid to the turning.

provided for, good breaks and scutching-stocks being obtained. This labour will cost from 1*s.* to 1*s.* 6*d.* per stone, according to the goodness and perfect ret and bleaching. The cultivator must be careful to instruct his scutcher to make the hemp up in half-stones of four heads each, tied round with its own heads tightly drawn through the hand; it makes it look remarkably neat; the pullings, as they are termed, are tied up in half-stones, with a band round the middle, the ends drawn together bound into a knot.

I will now notice what is to be done with the female or seed-hemp, provided the same is left for seed. In the fore part of September the seed-hemp will be ready for pulling; this may be known by observing and examining the four low seeds on the stem, called by growers elbow-seed; if they are of a dark grey colour and firm inside, and the husks turning a little yellow, it will be ready to pull. By this season strong winds may have occurred, so heavy as to break some of the seed-hemp: instructions must therefore be given to the women that pull the hemp, to gather the fallen stems (as they contain seed) and to be careful not to break the stem or cramp it in the hand, as it is termed. Breaking is very detrimental to hemp (I should have observed the same with regard to pulling white hemp). The same management has now to be observed with respect to retting, &c., as previously noticed with regard to white hemp. The seed-hemp should be set up in stooks of 40 gleans each; they are convenient for counting, and the under-growth must be raked up and spread evenly over the tops of the stooks to keep off the birds which will infest it, and the heads tied round with a band of the same material to keep the wind from disturbing it. The cultivator may know when the seeds are sufficiently matured to thrash out by the crispness of the capsules and the facility with which the seeds fall out. A cloth will now have to be procured and spread in some convenient part of the field, and a bolster raised on one side of the cloth from the wind to prevent the soil from falling on the cloth amongst the seed; the stooks must be drawn to the cloth without being taken to pieces, by a rope passing round the stook under the heads and passed over the drawer's shoulder: this requires a strong man;—he must then place the head part carefully on the cloth. To prevent loss of seed, thrashing ought to be proceeded with as soon as ready, as days at this season (September) are getting short, and fogs frequently occur, so that a single hour ought not to be lost. As soon as the hemp is thrashed, the grower may proceed to water it as directed for white hemp, or make it into a rick, and have what is called a spring-ret; if placed in a rick, care must be taken that it is properly thatched, as, if the least wet gets into the rick, it will destroy the fibre. The latter described mode was frequently practised if the season had got too far advanced for the hemp to be taken out of the water before the frost set in. In watering hemp, it must be a dead standing water; if put into a stream, the hemp will be damaged. The late hemp in the neighbourhood of Crowland was frequently watered and taken out of the water, dried as soon as possible, and peeled by women and children; it was of a coarse, tender, and ordinary quality, not applicable for shipping; it obtained only a low price, and was usually converted into sacking. To obtain the most valuable white hemp is to dew-ret it, which is done by letting it, after being pulled, stand in the stook two or three days in order to stiffen the stem, then carefully removing from the stook (without tying as before mentioned) and spreading on a good eddish where the grass is plentiful. It will take perhaps six weeks to dew-ret hemp, during which time it must be kept constantly turned over as previously described; it will be completed when the pink spots appear, as before noticed, which must be carefully looked for, when it will be ready to gather and tie up in bundles to form stooks in order to dry; the fibre will not sustain any damage before the pink spots appear.

The best land for obtaining fibre of the strongest and purest description is a fat loam, not too heavy with clay, and a portion of sand intermixed; on such land succeeding a crop of beans, hemp will grow 6 to 7 feet high. The cultivator will never be in error if he alternately sows beans and hemp. I have known 9 quarters of beans per acre after hemp, weighing 21 stones per sack. Hemp after beans will produce 30 stones more per acre of the strongest and heaviest fibre than by any other mode of culture: the weight of fibre in ordinary culture and circumstances will produce 60 to 70 stones per acre. After beans the produce will rate from 90 to 100 stones of a superior description; bean-stalks make the best manure for hemp, as they keep the land open and soft for the roots: this particularly applies to strong loams. Fat mould is well adapted for growing beans and hemp alternately: when I allude to fat mould, I do not mean mould that contains bog; that sort of mould produces hemp of a coarse ordinary quality of tender fibre, and obtains only an inferior price. In the hemp-growing districts, when it was much cultivated, it was usual to take two crops of hemp one after the other, and after the second crop a crop of flax, and then hemp, and so on for years. This was a practice amongst small farmers until the land became exhausted, as hemp and flax produce no manure. The most profitable mode of growing hemp is with beans alternately, for as many years as the farmer likes.

A good crop of hemp after beans will produce 28 to 30 bushels of seed per acre; in the ordinary way 20 to 22 bushels per acre.

Notwithstanding that heavy crops of beans and hemp, which has just been noticed, may, under favourable circumstances as to season, soil, manure and management, be obtained, the average will fall far short of it. The same great drawback exists in the growth of hemp that occurs in the cultivation of flax, viz. its non-production of manure—whilst, on the other hand, the manure-heap is drawn upon largely for this particular crop. It is quite true that means might be contrived to make the steep-water available as a top-dressing for grass land, and by consuming the seed and husks ground together a material can be obtained equal, in feeding value, to linseed. Yet, with all the economical management here pointed out, it is problematical if hemp-growing will ever prove productive; on particular soils, well adapted to beans and hemp, both of which are admirable preparations for wheat, it is possible that hemp may be profitably grown; but it must be borne in mind that hemp land will grow other crops of equal or superior value at a less cost—for instance, if an old pasture were broken up for hemp, the same soil would yield a crop of potatoes of equal value and at less expense and trouble. The only instance in which the hemp-culture can be profitably carried on is in connexion with a manufactory that will work up all the less valuable material: on a suitable soil, and when labour is cheap, this may be done with advantage, as the hands in the manufactory could be set to pulling, steeping, turning, &c., as they are employments requiring no particular skill. I throw out the hint, not expecting that it will ever be practised. On Chat Moss, a recently-cultivated bog, Mr. Redfern informs me that he grew hemp the last summer with the object of extirpating weeds, a purpose for which, in consequence of its rapid growth, it is well adapted.

The following may be taken as a fair average of the prospects of hemp-cultivation, both as regards cost and returns, viz. :—

EXPENSES.	£.	*s.*	*d.*
Rent and taxes, per acre	2	10	0
20 tons of manure	5	0	0
3 bushels of seed	0	15	0
Tillage	1	10	0
Pulling, steeping, &c.	1	10	0
Taking from steep, spreading, thrashing, &c.	2	5	0
Scutching 1*s.* 6*d.* per stone for 60 stone	4	10	0
Cleaning seed, taking to market, &c.	0	7	6
	18	7	6

PRODUCTS.

60 stones of hemp, at 4*s*. 6*d*. . . .	13	10	0
20 bushels of seed, at 4*s*. 6*d*. . . .	4	10	0
	18	0	0
Add thereto 10*s*. as value of dressing to grass-land or eddish, and for value of husks, &c., as feed for cattle, say 5*s*.	0	15	0
	18	15	0
Deduct expenses	18	7	6
Balance per acre in favour of the farmer .	0	7	6

When it is taken into consideration that hemp-culture is wholly different from the ordinary crops grown by farmers, and requires at particular seasons a great amount of labour and attention, I do not think it probable that its culture will ever be much practised. The prices for hemp and seed in the above account are certainly less than the present market price of both; good hemp will probably bring 5*s*. per stone, and good seed 5*s*. per bushel, or perhaps 5*s*. 6*d*. per bushel. I have, however, in the above only drawn an average.

Mr. Way, of Bridport, obtained, in the year 1811, the thanks of the Society for promoting Arts, and for his communication on the culture of hemp; and he mentions that the rotation practised in Somersetshire, Dorsetshire, &c., at that period was, on ground well manured, hemp, wheat, barley or oats; clover with the preceding wheat, barley, or oats; ground well manured, hemp, but sometimes they dress the ground well for hemp every third year. Hemp, like flax, should have a change of seed every second year. Mr. Way mentions that in America, in the neighbourhood of Boston, a favourite practice was to get off an early crop of tares, and follow with hemp pulled for the "white," and succeeded by turnips.

IX.—*On the Tussac Grass.* To Mr. MATHESON, M.P., from Mr. SCOBIE, in the island of Lewis.

SIR,—You wish me to send you a note of the culture of Tussac Grass in the Lewis. The seeds which you sent me in 1844 were sown in the following spring in various parts of the island, viz., Coll, Holm, Linshader, Galson, &c.; of all these the two former were the only places where this valuable grass appeared, and of these two Holm was the most successful and vigorous, being sown in a square plot of deep brown moss of medium dryness, close to the sea. The moss, scarcely yielding anything previous to its being turned over and enclosed, was delved over and cut into small pieces with the spade, and the seeds sprinkled in and roughly covered with a rake, and trampled in at the same time with the feet. The plants appeared during the following summer and harvest, and in September were examined by Mr. Charles Lawson, seedsman, Edinburgh, who pronounced them to be the real Tussac plant; the second year the stools were almost as strong as the third, though it is allowed this grass only attains its maturity the third year; it cast seed the second and third years. Three acres were delved over, of the same deep moss, in spring, 1847, to the depth of 12 inches, and, after it was packed with a hoe, a sprinkling of guano applied, and single plants dibbled in, three feet four inches apart. The whole of this prepared moss is drained three feet deep and 20 feet apart, being moss drains, shoulder or wedge as may be found most convenient, according to the consistency of the moss. The plant is succulent, with broad green leaves, and three feet long the second as well as the third year. Many of the stools, when planted out, were found to have 500 plants. From all I can see of this grass and its growth (in the latter particularly), it resembles the bent grass which grows on the sandy banks along the sea in the most exposed situations, though differing materially as to their nourishing qualities and the soil in which they flourish; still assimilating, in being so very much improved by culture and cutting, and being capable of being propagated to any extent by planting the tussac in moss, the bent in sand, each thriving best when most exposed to the sea. I think the moss for the tussac should be delved over in January, and a light spading of moss thrown over the surface, out of the bottom of the trench, to keep out the sun from drying up the moss too much: February, March, and April being most advisable for planting, May and June having proved too late and dry for transplanting. Bent grass I have found to succeed when transplanted any time from September to March, and tussac likely the same.

JOHN SCOBIE.

Holm, 2nd January, 1849.

To James Matheson, Esq., M.P.

Note.—March, 1849. Mr. Scobie found the plants to which he had applied sea-ware greener in the leaf and thriving better than the rest.

Some failures occurred from wet, rising from below in the moss, and also from imperfection in the drainage, and from drought, the peat being liable to become very hard in summer. Sea-ware, strewed on the surface, recommended.

It appears, from my own experience in Lewis, that the tussac grass there, as in its native region the Falkland Islands, requires to be within the near neighbourhood of the sea; that is, within a quarter of a mile, so as to catch the driving spray of the sea.

JAMES MATHESON.

Agricultural Chemistry Association,
8, *Bank Street, Edinburgh.*

15 *September*, 1847.

DEAR SIR,

I have the pleasure of enclosing the results of a comparative analysis of the three specimens of Tussac Grass, which you have sent here for examination—the one of last year, and the two of this season. You will observe that the proportion of watery extract hitherto considered to represent the nutritive value of grass, is greater in the Tussac Grass of the second than in that of the first year (1846).

This appears most clearly in the third line of No. 1. When the proportion of soluble matter in the dried plant is compared, that which you gave us last year was less succulent, or dryer than that we received this year, as the proportion of water in the two will show you. Hence the proportion of matter extracted by water from the grass of last year appears greater; though in reality, when compared in the dry state, water extracts more from the whole plant of this year. You will see also, however, that the under portion contains very much more soluble matter than the upper part. I would draw your attention further to No. 2, in which are embodied results not hitherto obtained from any other grass, and which, therefore, are not comparative.

In this table you see that potash extracts a considerable additional quantity, which water does not take. This I believe is also to be included in the proper nutritive matter of this grass.

In protein, or musile-forming compounds, it is also richer: in fact, as much so in the dry state as dry wheat or oats. I need not say, therefore, that, according to the results, Tussac Grass ought to be very nutritive.

Yours, &c.

Chas. Lawson, Esq. (Signed) JAS. T. W. JOHNSTON.

No. 1.—Proportion of Nutritive Matter extracted by Water in two samples of Tussac Grass grown on the Farm of Holm, in the Island of Lewis, from Seed sent by Mr. Matheson, M.P., proprietor, to Mr. Scobie, Chamberlain and Tenant of said Farm.

	Analysed by Dr. Frombog, Sept. 1846.	Analysed by Dr. Valcher, September, 1847.		
100 parts of the Grass in the state it was sent to the Laboratory contain—		Lower Part.	Upper Part.	Whole Plant.
Water	45·50	86·09	75·27	80·68
Watery Extract	9·4	4·34	3·64	3·99
100 parts dried at 212° contain—				
Watery Extract	17·24	31·17	14·72	22·94

No. 2. Composition of Tussac Grass.

	In the Recent State.		Dried at 230°.	
	Lower Part.	Upper Part.	Lower Part.	Upper Part.
Protein Compounds	2·47	4·79	17·81	19·38
Sugar, Gum, and Extracting Matter, extracted by Water	3·32	3·64	23·88	8·93
Other Nutritive Substances, insoluble in Water, but extracted by Potash	1·30	3·17	9·20	18·63
Woody Fibre (Cellalose with a little Albumen)	5·68	11·86	40·88	47·94
Saline Matter (Ash)	1·14	1·37	8·23	5·12
Water	86·09	75·27	..	..
	100	100	100	100

X.—*On Labourers' Cottages.* From his Grace the DUKE OF BEDFORD.

To the President.

MY DEAR LORD CHICHESTER,—Observing in the last volume of the Royal Agricultural Society's Journal that the Council is directing its attention to that very important subject, the improvement of agricultural labourers' cottages, feeling (in common, I have no doubt, with many other proprietors of estates) greatly interested in it, and having bestowed upon it much and anxious consideration, I am desirous of giving to others the benefit of my inquiries and experience, to enable them to follow the system I am adopting, so far as they may think it expedient to do so; and I therefore beg leave to offer to the Society copies of the plans and drawings according to which I have lately erected some cottages, and intend to erect many more, on my Bedfordshire and Devonshire estates.*

My inquiries into the condition of the cottages on those estates led me to the conclusion, first, that, notwithstanding a very considerable annual expenditure upon them, many of them were so deficient in requisite accommodation as to be inadequate to the removal of that acknowledged obstacle to the improvement of the morals and habits of agricultural labourers, which consists in the

---

* It is due to his Grace to mention that the original sketches and plans have necessarily been very greatly reduced in size for publication in this Journal, and also that only a selection from them is here given.—PH. P.

want of separate bed-rooms for grown-up boys and girls; and, secondly, that the practice of taking in lodgers had led to still further evils. The improved methods of cultivation, extensive draining, and general improvement in husbandry (requiring additional hands) that are going on, more or less, in all parts of the country, and the breaking up of inferior grass-lands, and converting woodland into tillage (especially since the passing of the Tithe Commutation Act), by giving work to many more labourers than were formerly employed, have caused a proportionate augmentation of their number, and, consequently, an increased want of cottage accommodation. To meet this increased want, and at the same time to improve the habitations of the labourers, I determined to rebuild the worst of my cottages, and to add to their number in those parts of my estate in which it appeared necessary to do so. I therefore directed my surveyor to prepare a series of plans of cottages suitable for families of different sizes and descriptions, sufficient to satisfy the reasonable wants of the labourers and their families, and to be so constructed as that (avoiding all needless expense) the cottages should be substantial, and not subject to premature decay, or likely to require costly repair.

The experience obtained in erecting the new cottages already built on my estate has enabled my surveyor to ascertain the quantities of each kind of material required for the construction, separately, of the cottages shown in these plans; and in the hope that this information may be useful to others, I have directed those quantities to be put in detail upon the plans. I have deemed it best not to have the prices added, because prices vary in different localities, and therefore to furnish the prices of one locality would be useless, and might mislead. The quantities being given, it will be easy to add the prices they bear in other places in which the erection of cottages according to those plans may be desired.

As the cottages of many landed proprietors may be, and probably are, in a state similar to my own, it appears to me that the information, founded on actual experience, which I have obtained on the subject of cottage-building, and which is embodied in these plans, may be acceptable and generally useful.

Cottage-building (except to a cottage speculator who exacts immoderate rents for scanty and defective habitations) is, we all know, a bad investment of money; but this is not the light in which such a subject should be viewed by landlords, from whom it is, surely, not too much to expect that, while they are building and improving farm-houses, homesteads, and cattle-sheds, they will, also, build and improve dwellings for their labourers in sufficient number to meet the improved and improving cultivation of the land.

But in adding to the number of cottages on our estates, there should, of course, be a limit, or we may fall into evils of another kind. That limit may easily be drawn, either by the proprietor himself, or by an intelligent steward, and made to agree with the reasonable wants of the districts or parishes in which his employer's estates are situated.

To improve the dwellings of the labouring class, and afford them the means of greater cleanliness, health, and comfort, in their own homes, to extend education, and thus raise the social and moral habits of those most valuable members of the community, are among the first duties, and ought to be among the truest pleasures, of every landlord. While he thus cares for those whom Providence has committed to his charge, he will teach them that reliance on the exertion of the faculties with which they are endowed is the surest way to their own independence and the well-being of their families.

I shall not dwell, as I might, on the undeniable advantages of making the rural population contented with their condition, and of promoting that mutual good-will between the landed proprietor and the tenants and labourers on his estate, which sound policy and the higher motives of humanity alike recommend.

Having lately had the pleasure of visiting with you some of the cottages on your estate in Sussex, knowing the interest you take in the subject, and having witnessed your success in carrying into effect the views we alike entertain upon it, it is gratifying to me to be able to address this communication to you as President of the Royal Agricultural Society for the present year.

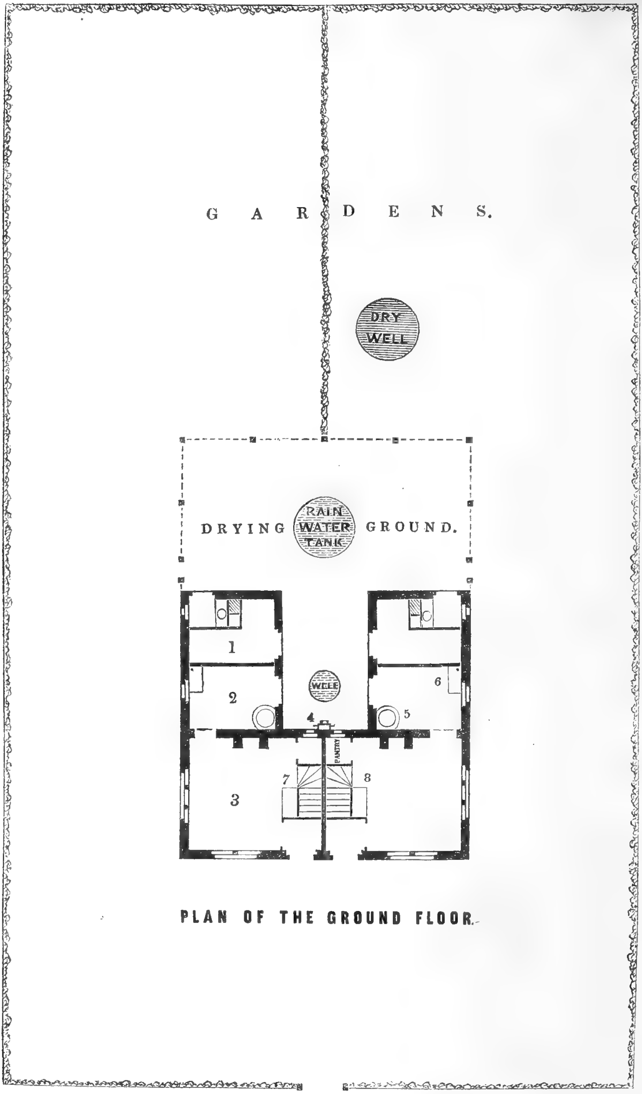
I remain, my dear Lord Chichester, with sincere regard and esteem, faithfully yours,

BEDFORD.

Woburn Abbey, March, 1849.

PLANS AND ELEVATIONS FOR LABOURERS' COTTAGES.

TWO WITH ONE BED-ROOM EACH.

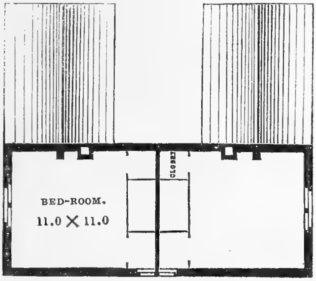


PLAN OF THE GROUND FLOOR.

1. Wood and Coals...10.0 × 6.0
2. Wash-house.......10.0 × 6.0
3. Kitchen...........11.0 × 11.0
4. Pump.
5. Copper.
6. Sink.
7. Dresser.
8. Do.

Scale of Feet. 10 5 0 10 20 30

ELEVATION OF THE FRONT.



PLAN OF THE BED-ROOM FLOOR.

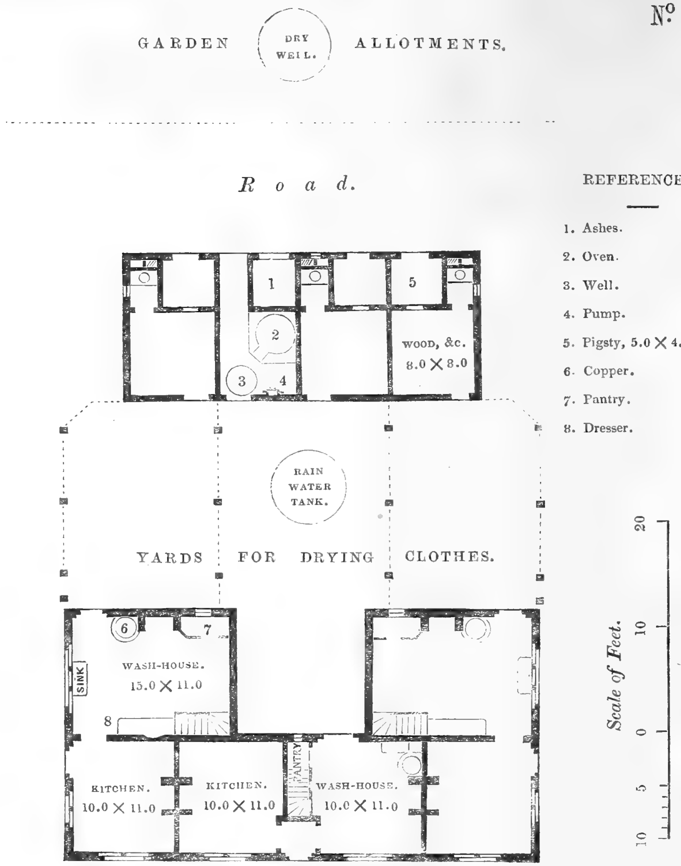
ELEVATION OF THE ENDS.

QUANTITIES.

			£. s. d.
22,950	Building bricks		
35 lds.	Sand		
30 qrs.	Lime		
10 bus.	Cement		
1750	6 in. paving squares		
124	12 in. shell drain tiles		
54	18 in. earthen pipes, 6 ins. diam.		
7020	Plain tiles		
84	Valley tiles		
44	18 in. ridge tiles		
10 bun.	Tiling laths		
14 do.	Plastering laths		
qrs. lb. 2 0	Hair		
3	York stones for manholes . .		
4	Small scrapers and stones . .		
2	Do. stone sinks with grates, waste pipes, and traps . .		
146 ft.	Cube fir		
2 ft. 1 in.	Do. oak		
37⅔	12 ft. 3 by 9 in. deals		
10	Posts to fences and hand gates, 3 ft. out of ground		
3	Drying posts, 7 ft. out of grnd.		
8 leng.	Rails and palings, 3 ft. high .		
3	Hand gates, with hinges and latches		
2	Solid door-cases, with ledged doors, hinges, and latches, complete		
6	Ditto, with stock-locks . . .		
2	Small louvre frames to privies		
4	Solid one-light window-frames, with iron quarry lights to open, glazed, complete . .		
5	Two light ditto, one to open .		
2	Three light ditto and ditto .		
24	Iron cloak pins		
12 prs.	14 in. cross garnetts		
12	Thumb-latches		
12	Tower bolts		
4	Chimney-pots		
2	Bedroom stoves, and fixed . .		
163 ft.	Iron eaves, gutter, and stack-pipe, fixed, complete . . .		
1	Double pump, with suctions to draw from well and tank .		
2	Common closet apparatus, with supply cistern and service from pump to each		
	Nails and screws		
qrs. lb. 3 0	Oil-paint		
	Labour		
	Cartage		
	£.		

PLANS AND ELEVATIONS FOR LABOURERS' COTTAGES.

TWO WITH THREE BED-ROOMS, AND ONE WITH TWO BED-ROOMS.



REFERENCES.

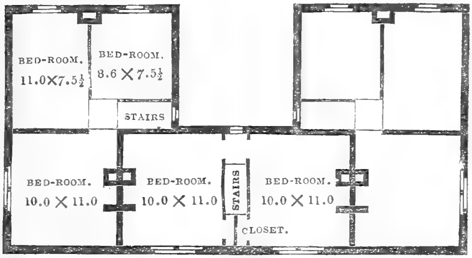
1. Ashes.
2. Oven.
3. Well.
4. Pump.
5. Pigsty, 5.0 × 4.7
6. Copper.
7. Pantry.
8. Dresser.

PLAN OF THE GROUND FLOOR.

QUANTITIES FOR HOUSES.

			£. s. d.
38,830	Building bricks		
56 qrs.	Lime		
58 lds.	Sand		
10 bus.	Cement		
3,190	6 in. paving squares		
12,150	Plain tiles		
374	Valley tiles		
69	18 in. ridge tiles		
21 bun.	Tiling laths		
29 do.	Plastering laths		
2 c. 2 qr.	Hair		
6	Small scrapers and stones		
3	York sinks, with grates, waste pipes, and traps		
245½ ft.	Cube fir		
2 do.	,, oak		
65½	12 ft. 3 by 9 in. deals		
3	Solid door-cases and ledged doors, with hinges, latches, and bolts		
3	Ditto and ditto, with hinges, latches, and stock-locks		
	£.		
6	Small one-light solid window-frames, with iron quarry lights to open, glazed, complete		
4	One-light window-frames, and ditto		
10	Two light ditto, one each, to open, and ditto		
2	Three light ditto, one each, to open, and ditto		
	Nails and screws		
20 prs.	Cross garnett hinges		
20	Thumb-latches		
36	Iron cloak-pins		
10	Chimney-pots		
4	Bedroom stoves, fixed, complete		
3	Kitchen ditto and ditto		
157 ft.	Iron gutter and down pipes, fixed, complete		
1 c. 2 qr.	Paint		
	Labour		
	Cartage		
	£.		

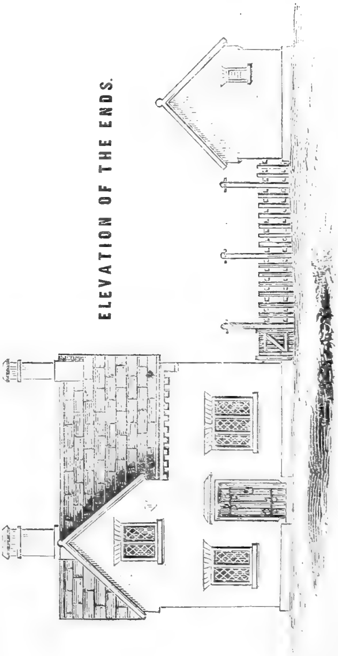
ELEVATION OF THE FRONT.



PLAN OF THE BED-ROOM FLOOR.

QUANTITIES FOR OUTBUILDINGS, &c.

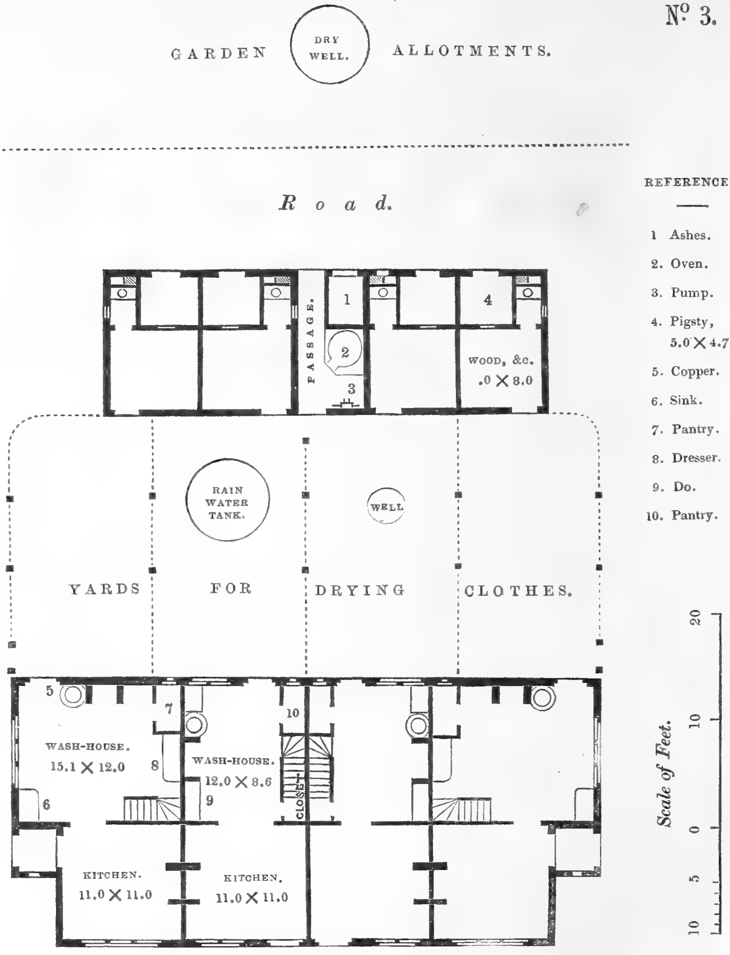
		£. s. d.
20,500	Building bricks	
24 qrs.	Lime	
27 lds.	Sand	
30 bus.	Cement	
420	6 in. paving squares	
10	12 in. oven do.	
6950	Plain tiles	
160	12 in. shell drain tiles	
133	18 in. drain pipes, 6 ins. diam.	
28	18 in. ridge tiles	
8⅓ bun.	Tiling laths	
3	York man-hole stones	
6	Do. door cills	
6 prs.	Do. hook-stones, with iron hooks	
6	Do. catch-stones, with iron catches	
75 ft.	Cube fir	
2⅓	12 ft. 3 by 9 in. deal	
3	Small louvre frames	
3	Do. piggery feeding doors, with hinges, hasps, and staples	
3	Ledged piggery doors, with hook hinges only, and hasps and staples	
3	Do. privy-doors, with hinges, latches, and bolts	
4	Do. outer-doors, with hook hinges only, latches, and stock-locks	
8	Fencing posts, 3 ft. out of ground	
8	Drying posts, 7 ft. ditto	
16 leng.	Rails and palings, 3 ft. high	
2	Hand gates, with hinges and latches	
	Nails and screws	
1	Oven-door and frame	
3	Com. closet apparatus, with supply cisterns, and service from pump to each	
1	Double pump, with suctions to draw from well and tank	
2 qrs.	Paint	
	Labour	
	Cartage	
	£.	



ELEVATION OF THE ENDS.

PLANS AND ELEVATIONS FOR LABOURERS' COTTAGES.

TWO WITH THREE BED-ROOMS, AND TWO WITH TWO BED-ROOMS.



REFERENCES.

1 Ashes.
2. Oven.
3. Pump.
4. Pigsty, 5.0 × 4.7
5. Copper.
6. Sink.
7. Pantry.
8. Dresser.
9. Do.
10. Pantry.

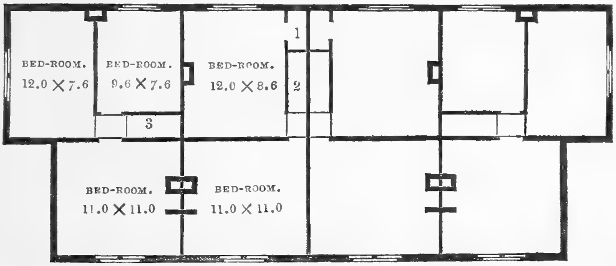
PLAN OF THE GROUND FLOOR.

QUANTITIES FOR HOUSES.

			£. s. d.
46,970	Building bricks		
66 qrs.	Lime		
68 lds.	Sand		
13 bus.	Cement		
4,560	6 in. paving squares		
12,890	Plain tiles		
420	Valley do.		
68	18 in. ridge do.		
22 bun.	Tiling laths		
38 do.	Plastering do.		
2 c. 3 qrs.	Hair		
8	Small scrapers and stones		
4	York sinks, with grates, waste pipes, and traps		
325 ft.	Cube fir		
2 ft.	Do. oak		
4	Solid doorcases, with ledged doors, hinges, latches, and bolts, complete		
4	Do. and do., with stock-locks		
	£.		
86	12 ft. 3 by 9 in. deals		
4	Small solid one-light window-frames, with iron quarry lights to open, glazed, complete		
14	Two light window-frames, one each to open, and ditto		
4	Three light ditto and ditto		
	Nails and screws		
48	Iron cloak-pins		
26 prs.	Cross garnett hinges		
26	Thumb-latches		
8	Chimney-pots		
4	Bedroom stoves, fixed, compl.		
4	Kitchen ditto and ditto		
171½ ft.	Iron guttering and down-pipe, fixed, complete		
2 c. 1 qr.	Paint		
	Labour		
	Cartage		
	£.		

ELEVATION OF THE FRONT.

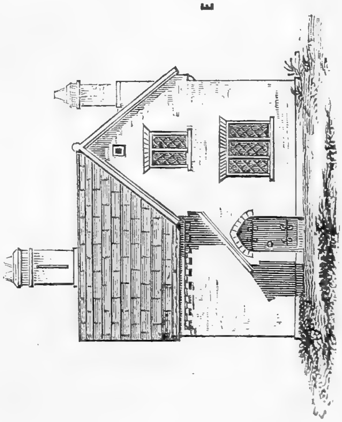
1. Closet.
2. Stairs.
3. Do



PLAN OF THE BED-ROOM FLOOR.

QUANTITIES FOR OUTBUILDINGS, &c.

			£. s. d.
23,240	Building bricks		
27 qrs.	Lime		
31 lds.	Sand		
30 bus.	Cement		
480	6 in. paving squares		
10	12 in. oven do.		
7130	Plain tiles		
185	12 in. shell drain tiles		
200	18 in. drain pipes, 6 ins. diam.		
29	18 in. ridge tiles		
12 bun.	Tiling laths		
3	York man-hole stones		
8	Do. door cills		
9 prs.	Hook-stones, with iron hooks		
9	Catch-stones, with iron catches		
82 ft.	Cube fir		
3¼	12 ft. 3 by 9 in. deals		
4	Small louvre frames		
4	Do. piggery feeding doors, with hinges, hasps, and staples		
4	Ledged privy-doors, with hinges, thumb-latches, and bolts		
4	Ledged pigsty doors, with hook hinges only, and hasps and staples		
5	Do. outer doors, with hook hinges only, latches, and stock-locks		
16	Fencing posts, 3 ft. out of ground		
10	Drying do. 7 ft. do.		
17 leng.	Rails and palings, 3 ft. high		
4	Hand gates, with hinges and latches		
	Nails and screws		
1	Oven-door and frame		
1	Double pump, with suctions to draw from well and tank		
4	Common closet apparatus, with supply-cistern and service from pump to each		
qr. lb. 2 14	Paint		
	Labour		
	Cartage		
	£.		

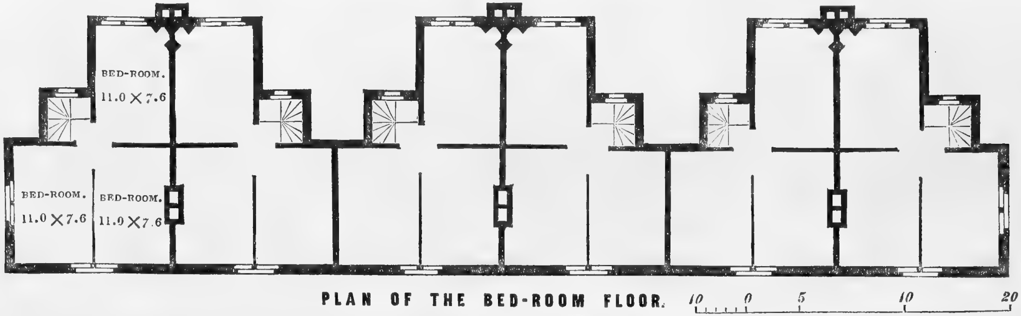


ELEVATION OF THE ENDS.

PLANS AND ELEVATIONS FOR LABOURERS' COTTAGES.

SIX WITH THREE BED-ROOMS EACH.

ELEVATION OF THE FRONT.



PLAN OF THE BED-ROOM FLOOR.

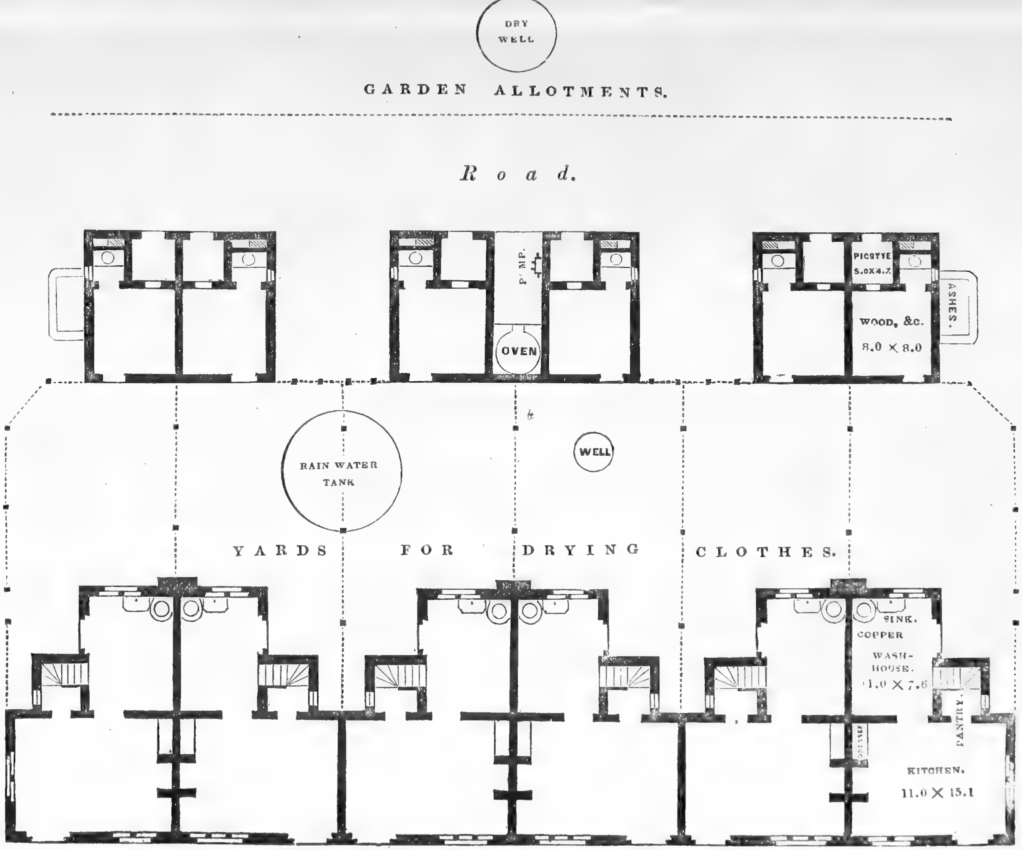
No. 4.

QUANTITIES FOR HOUSES.

			£. s. d.
70,150	Building bricks		
99 qrs.	Lime		
104 lds.	Sand		
20 bus.	Cement		
6,540	6 in. paving squares		
25,725	Plain tiles		
917	Valley tiles		
150	18 in. ridge tiles		
45 bun.	Tiling laths		
50 do.	Plastering do.		
C. qr. lb. 3 1 0	Hair		
12	Small scrapers and stones		
6	York sinks with grates, waste pipes, and traps		
668 ft.	Cube fir		
4½ do.	,, oak		
99½	12 ft. 3 by 9 in. deals		
6	Solid door-cases and ledged doors with hinges, thumb-latches and bolts		
6	Ditto and ditto with hinges, thumb-latches, and stock-locks		
12	Small solid window-frames, with iron quarry lights, to open, glazed, complete		
24	Two light window-frames, and ditto one each to open		
4	Three light window-frames, and ditto		
	Nails and screws, &c.		
72	Iron cloak pins		
36 prs.	Cross garnett hinges		
36	Thumb-latches		
18	Chimney-pots		
6	Bedroom stoves, fixed, complete		
277 ft.	Iron gutter and down-pipe do.		
C. qr. lb. 3 1 0	Paint		
	Labour		
	Cartage		
	£.		

QUANTITIES FOR OUTBUILDINGS, &c.

			£. s. d.
34,800	Building bricks		
40 qrs.	Lime		
46 lds.	Sand		
40 bus.	Cement		
720	6 in. paving squares . . .		
10	12 in. oven do.		
10,940	Plain tiles		
545	12 in. shell drain tiles . . .		
217	18 in. drain pipes, 6 ins. diam.		
120	18 in. ridge tiles.		
16 bun.	Tiling laths		
3	York man-hole stones . . .		
12	Do. door cills		
12 prs.	Hook-stones, with iron hooks .		
12	Catch-stones, with iron catches		
302½ ft.	Cube fir		
4⅔	12 ft. 3 by 9 in. deals . . .		
6	Small solid louvre frames . .		
6	Do. piggery feeding doors, with hinges, hasps, and staples .		
6	Ledged privy-doors, with hinges, latches, and bolts .		
6	Do. piggery-doors, with hook-hinges only, and hasps and staples		
6	Do. outer doors, with hook-hinges only, latches, and stock-locks		
28	Fencing posts, 3 ft. out of grd.		
14	Drying do., 7 ft. out of ground		
39 leng.	Rails and palings, 3 ft. high .		
6	Hand gates, with hinges and latches		
	Nails, screws, &c.		
1	Oven-door and frame . . .		
1	Double pump, with suctions to draw from well and tank .		
6	Common closet apparatus, with supply - cistern and service from pump to each . . .		
qrs. lb. 3 14	Paint		
	Labour		
	Cartage		
	£.		



PLAN OF THE GROUND FLOOR.

XI.—*On the Composition and Money Value of the different Varieties of Guano.* By J. THOMAS WAY, Consulting Chemist to the Royal Agricultural Society.

TIME, which brings change to every thing, has not been idle with agriculture. Every year ushers in some novelty, if not improvement, in the shape of new implements, new plants for cultivation, and new manures. Not the least remarkable of these introductions in modern times is that of *guano*. The farmer who employs, it may be, a few cwts. of this manure in the year, hardly troubles himself to inquire the amount which is annually imported into England, the distance which it is brought, and the capital which is employed in its transmission. In one year between three and four hundred thousand tons of all varieties are said to have been imported; and at the present time the yearly consumption in this country alone of Peruvian guano does not fall short of 80,000 or 100,000 tons. What then is guano? and to what does it owe that undeniable fertilizing power which can repay the cost of bringing it so many thousand miles across the seas?

It does not come within the scope of the present article to offer a *history* of guano, or to recount the wonders which it has effected in the production of all kinds of crops. The reader may refer to Professor Johnstone's paper on guano in this Journal (vol. ii. pt. iii.) for a very interesting account of this singular substance; and if he requires any evidence of its value as manure, he will find such distributed through any and every agricultural publication of the last eight years.

It will also occur to him that it has not been left to the present time or to the present writer to place before the public as a novelty the analysis of guano; on the contrary, many very careful and elaborate analyses have been undertaken for the purpose of indicating the true composition of the different varieties, and, as it is of a highly complex nature, analytical skill of no ordinary kind has been brought to bear upon its examination. Baron Liebig has collected in an appendix to his fourth edition of 'The Chemistry of Agriculture' very many of the analyses of guano which had been published up to the date of that work, and as they comprehend pretty nearly all that is known of its composition, the reader may be referred to the book in question for this information.

These analyses however, highly valuable as they undoubtedly are in a scientific point of view, are too much complicated by the minuteness of their details to convey to the mind any definite notion of the precise manurial value of guano, still less are they applicable to calculations having in view the comparison of the different varieties, in an agricultural sense, or the determination of their average money value in relation to other recognised manures.

To obviate this defect, and to place in a clear light the differences which exist between the different varieties—to contrast the money value of the specimens—and, having decided upon the constituents to which their manurial efficacy is to be ascribed, to speculate upon the possible substitutes for guano on the score of economy, or in the event of an ultimate failure of its supply—such are the objects of the present paper.

It is taken for granted that no one who will take the trouble of reading papers of a scientific character in reference to agriculture needs to be furnished with arguments to prove that guano acts as a manure because *it contains something or other* that is favourable to the growth of plants, that is to say, that there is no talismanic or mysterious principle about it which would elude inquiry or defy imitation, but that it is perfectly practicable to ascertain what the constituent or constituents are which make it a fertilizer; and that, having so ascertained its active ingredients, a *fac simile* of the substance might be prepared by a combination of them from other sources; and that, whatever these sources might be, the compound so prepared would have all the properties and efficacy of the guano which it was intended to imitate.*

Guano then owes its efficacy as a fertilizer to some one or more *definite* ingredients. The question is, Do we know what the *active* constituents of guano are? and is its composition for the *practical purposes* of agriculture capable of being regarded in a simple light, and of being made the subject of distinct calculation? It is hoped that these queries may very readily be answered in the affirmative.

For an instant let the reader give his attention to the elaborate analyses of guano before alluded to. He will find that mention is made of the *urate*, oxalate, humate, &c., of ammonia; these are what chemists call "*organic* salts:" then, again, of the phosphate, carbonate, and muriate of the same alkali. He will also observe that guano contains sulphates, carbonates, phosphates, and muriates of lime, magnesia, potash, and soda; and lastly, organic matters containing nitrogen. Now what does all this amount to? Is it meant that every one of these compounds has its distinct and individual share in the action of guano as manure; that the oxalate of ammonia will have a different effect, and consequently a different value, to the carbonate; that it will be of material importance that the phosphate of lime and the phosphate of magnesia should be separately considered? Surely not. It was before observed, that the analyses in question are of a scientific rather than a practical tendency, and that they were not made with a view to agricultural

---

* This is not *literally* true. Uric acid is only to be obtained from one or two sources, such as the solid urine of serpents or the dung of sea-fowl, which latter is in fact guano. Guano is therefore a manure *sui generis*, and it is impossible to produce a perfect imitation of it.

application. It may well be, indeed, that every difference in the constitution of a salt will give it a distinct influence on the growth of plants; but it is far more consistent with the present position of the chemistry of agriculture to refer the value of different chemical compounds as manure to the proportion which they respectively contain of the known agents of vegetation, making, at the same time, due allowance for the state of solubility and other accessory circumstances. Thus, if it were a question between the carbonate and oxalate of ammonia, we must, with our present knowledge, value them solely by the relative amount of ammonia they contain, setting aside altogether the difference of the acid with which they are combined.

It often happens that we have to deal with compounds which may be supposed to possess more than one source of importance in an agricultural point of view; thus, for instance, *sulphate of potash* is capable of supplying two, in fact three, necessary substances to a growing plant—sulphuric acid, sulphur, and potash. It is plain that in this case we must place a value, not only upon the potash, but upon the sulphuric acid, since it is known that both these constituents form part of the materials with which Nature builds up her vegetable structures. But there is no reason to think that the sulphur or sulphuric acid of sulphate of potash is more easy of acquisition than the sulphuric acid or sulphur of sulphate of lime. As a source of these substances to plants, the relative value of the two salts is to be decided solely by the *quantity* they contain. Then, again, we are not prepared by any means to allow that one salt of any given substance, such as ammonia, will be more efficacious as a manure than another compound of the same substance with a different acid; there are, for instance, no good grounds for believing that sulphate of ammonia is different in its action to sal-ammoniac, otherwise than in containing a different proportion of the important ingredient, the ammonia. But, as before said, there can be no equality between the phosphate and muriate of ammonia, because the former supplies two highly important elements of vegetation, the latter only *one*.

If (*as a provisional doctrine only*) it may then be considered safe to value the different chemical substances in reference to vegetation simply by the quantity of the different constituents which they can supply, we shall have made very great advance towards simplifying our views upon these points, and shall much more readily reduce the question to one of practical economy. This doctrine, when applied with the requisite judgment, will, it is conceived, be not very far from the truth, and it is especially useful in estimating the value of guano.

Very many of the analyses which are introduced in this paper were made in my laboratory by Mr. Ogston, Mr. Ward, and Mr. Eggar, and as the greater number of them were undertaken with the express purpose of throwing light upon the agricultural value of guano, and upon the extent of variation in its composition, great pains have been taken to render the results perfectly trustworthy and unexceptionable.

I am indebted to Mr. Lawes for several of the specimens of which the analysis is given, and for much information and assistance in the course of my inquiries. The samples given me by Mr. Lawes were taken from the cargoes in the docks, mostly by himself, and with every care that they should represent truly the bulks from which they were separated; that they are really fair averages of the respective cargoes I shall attempt to show in a subsequent part of this paper.

To Messrs. Gibbs and Sons, the importers of Peruvian guano, I owe the opportunity of selecting specimens of this year's importation. These gentlemen, having become aware of my intention of publishing the results of my earlier analyses, placed themselves in communication with me, and afforded me every facility in taking samples from the ships in dock.

In addition to the analyses made in my own laboratory, I am enabled, by the kindness of Mr. Lawes, to enrich this paper by the introduction of many others which have been from time to time made for him by Dr. Ure and Mr. Teschemacher, and which are now published for the first time.

The following analyses of different specimens of guano will present to the reader its *ultimate* composition (more especially as regards the mineral portion), and will enable him to judge to which of its constituents, according to the rules before laid down, he should attribute its principal value in relation to other available manures.

TABLE 1.—Composition of Eight Specimens of Peruvian Guano.*

	A.	B.	D.	C.	E.	F.	G.	H
Water	18·33	17·95	12·57	12·58	12·29	13·09	14·54	13·67
Organic Matter and Salts of Ammonia .	47·04	47·46	33·67	46·61	48·76	49·32	50·81	52·97
Sand and Silica . .	1·31	1·34	1·72	2·79	1·15	1·42	1·12	1·42
Phosphoric Acid .	12·41	13·16	20·21	14·37	13·61	14·48	14·08	14·56
Sulphuric Acid . .	3·83	3·47	4·00	4·54	4·57	4·00	3·60	2·52
Lime	9·70	10·73	16·49	11·47	11·32	10·84	9·68	10·38
Magnesia	·70	·52	·80	·62	·78	·74	·54	·31
Oxide of Iron . .	·27	·15	·22	·23	·23	·23	·20	·73
Potash	3·07	2·52	3·60	3·22	4·95	2·9	3 40	1·42
Soda	2·13	·30	4·15	·91	·11	·7	·74	none
Chloride of Potassium	none	none	none	none	none	none	none	2·02
Chloride of Sodium .	1·21	2·40	2·57	2·66	2·23	2·19	1·29	none
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

---

* For methods of analysis, &c., *see* Appendix.

In reference to this table, and passing by for the present the proportion of water and organic matter, for the notice of which a better opportunity will presently occur, we may observe that the *mineral* value of guano would seem to consist solely in the phosphate and sulphate of lime and potash. Of soda there is very little, except in the form of common salt, whilst the proportion of magnesia is so small as hardly to deserve notice.

It is an interesting and important fact that guano should contain so much potash as is shown by this table to be the case: that the proportion of the alkali is frequently as much as or more than 3 per cent. of its weight is proved by the examination of other specimens. The following are the per-centages of potash and soda in eight other samples of Peruvian guano, of whose further composition we shall shortly have occasion to speak :—

Potash in 100 parts	3·27	3·19	3·43	4·60	3·43	3·74	6·49	3·73
Soda	1·87	·63	·75	none	1·03	·51	·67	·79

Although the chlorine has not in these latter cases been determined, it is probable that, as in the other eight samples, the soda principally occurs as common salt. I shall shortly point out that potash is not *always* found to the same extent as in the tables; but my present purpose is to show that in guano the ingredients of any value are few and simple. Reverting to the table, we find that under the head of "Animal Matters and Salts of Ammonia" is comprehended in most cases nearly one-half of the weight of the guano. These animal matters are of value as manure, solely in proportion to the *ammonia* which they can supply; sooner or later they pass into decomposition, giving rise to the usual products. It may be thought by some that as carbonic acid is one of these products, and as it is well known that this gas is an agent in vegetation, a certain allowance should be made for the carbonaceous elements. There is, indeed, no doubt that the more *dilute* manures owe much of their efficacy to the compounds of carbon, but these are always supplied in large quantity, whereas the amount of carbonaceous manure furnished by a fair dressing of guano is really too inconsiderable to be taken into account. The "organic matters and ammoniacal salts," then, must be valued only so far as they can supply ammonia. But it is to be observed that part of these substances (as the carbonate and other salts of ammonia) is capable of furnishing ammonia immediately; whilst the other portion (the animal matter—the *uric acid,* for instance) will require more or less time to become converted into it, although to this point they will all eventually come. Founded upon this circumstance some chemists have proposed to distinguish the actually existing ammonia from that which will eventually be derived from the guano. Dr. Ure (who has published an able paper on the analysis of guano in this Journal, vol. v. p. 287) has called the former the *actual* and the latter the *potential* ammonia; and in making this distinction he obviously considers it important for the farmer to know how much *is* and how much *will be* available to the crop for which the guano is applied. If we had any knowledge of the time which these animal compounds require for their decomposition when distributed through any given soil, some advantage might accrue from this refinement, although from the ever-changing circumstances to which a manure is exposed in the soil, the distinction would possess little *practical* utility; but it appears to me that in the absence of such knowledge it is far wiser to take the more simple view. It is believed therefore that the value of the organic part of guano is solely dependent upon the proportion of ammonia which it can eventually supply, without reference to the present state of the compounds which will furnish it.

With respect to the particular constituents which constitute the mineral value of guano there can be little doubt: magnesia and oxide of iron, as existing in minute quantity only, are already disposed of; soda, whether in the state of common salt or in any other form, exists in such small proportion, and, as will be presently shown, could be supplied from independent sources at such a trifling cost, that little or no *money value* can be attached to it: the same is true of the sulphuric acid, for which gypsum at an almost nameless expense would be an ample substitute. There only now remains the phosphoric acid combined with lime and the potash; and these with the ammonia are really the important, and the only important, ingredients in guano.

If the arguments which have been brought forward are considered satisfactory, we shall have arrived at a much simpler notion of the agricultural value of guano than would be derived from an examination of its recondite analysis. The only important constituents will be reduced to these:—

1. Ammonia or its elements.
2. Phosphate of lime.
3. Potash.

It is proposed in a later part of this paper to consider the money value of guano and its constituents, and it will then be more apparent that the view we have now taken of its composition is a just one. In the meanwhile we may properly introduce the analysis of a number of specimens which have been examined upon the principles now brought forward.

The following table contains the analysis of eight specimens of guano taken from the docks in 1847 and 1848, and analyzed in my laboratory:—

TABLE 2.—Peruvian Guano imported in 1847-8.

Number of Specimen	1	2	3	4	5	6	7	9
Name of Ship . .	"Agamemnon."	"General Alaix."	"Manchester."	"Queen of the Isles."	"Director."	"Othello."	"Parkfield."	"Osprey."
Water.	16·16	17·29	8·88	22·68	17·95	16·72	12·57	15·85
Organic Matter and Salts of Ammonia.	57·13	50·66	58·82	44·19	51·39	51·35	37·78	55·28
Sand	1·17	1·64	1·36	1·22	1·34	1·58	1·72	1·23
Earthy Phosphates .	19·46	23·07	25·27	28·83	20·98	29·74	34·45	20·30
Alkaline Salts . .	6·08	7·34	5·67	3·08	8·34	·61	13·48	7·34
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Ammonia supplied by 100 parts of each Specimen . . .	18·94	17·46	17·86	16·83	18·01	16·40	18·50	16·92

A few words will serve to explain the present table as well as those which follow it. The methods of analysis (described in the Appendix) are so arranged as to exhibit the total quantity of ammonia and the earthy phosphates, together with the proportions of sand and water. Under the head of "Alkaline Salts" are included the sulphates and muriates of potash and soda, together with any deficiency occurring in the analysis. The quantity of potash is not here specified: in sixteen specimens it has, however, been before given.

The specimens whose analysis is given in the 3rd table have been obtained from various persons during the last twelve or eighteen months. Coming through indirect channels, I am not able to speak of them with the same confidence as of those which have been sampled directly from the ships.

Their composition is, however, for the most part such as to leave no doubt of their being genuine specimens of Peruvian guano. Specimens 12 and 13 in the table will be seen to be rather below the usual mark in respect of ammonia. They are duplicates of the same cargo; and, from the price at which the guano was bought, I have no doubt that it was what by the importers is called "damaged guano," and sold at a reduced price.*

---

* For an analysis of damaged guano, *see* Appendix.

TABLE 3.—Peruvian Guano.

Number of Specimen	10	11	12	13	14	16	17	18	19	20
Water	14·61	10·13	21·87	23·74	18·33	16·88	13·09	11·24	19·79	9·76
Organic Matter and Salts of Ammonia	51·38	58·07	48·72	47·35	51·24	54·81	53·32	55·17	52·53	48·54
Sand	1·68	1·31	1·01	1·11	1·31	1·12	1·42	1·46	2·61	1·83
Earthy Phosphates .	23·86	21·16	21·09	19·80	21·79	21·75	26·29	27·89	24·08	28·02
Alkaline Salts . . .	8·47	9·33	7·31	7·80	7·33	5·44	5·88	4·24	·99	11·85
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Ammonia yielded by 100 parts of each Specimen .	16·18	18·66	14·04	15·51	16·60	16·81	17·06	18·27	Not ascertained	17·55

The next analyses are those of samples sold to different persons as good Peruvian guanos, but which are so low in ammoniacal composition as to lead to a doubt of their genuineness:—

TABLE 4.—Inferior Guanos.

Number of Specimen	21	22	23
Water	19·74	11·29	11·22
Organic Matter and Salts of Ammonia	46·17	46·45	34·68
Sand	2·46	2·63	5·44
Earthy Phosphates	31·59	26·71	21·09
Alkaline Salts	·04	12·92	25·71
	100·00	100·00	100·00
Ammonia yielded by 100 parts. .	11·89	10·41	8·12*

The large proportion of "alkaline salts" in the third specimen is due to the presence of a quantity of gypsum and common salt with which the guano has been adulterated, whilst at the same time the proportion of earthy phosphates has been kept up probably by the mixture of a certain quantity of one of the cheaper varieties of guano.

The next specimens are from the importations of the latter part of 1848 and the beginning of the present year (1849).

The first 8 of the following table were taken from the warehoused cargoes by Mr. Lawes. Nos. 29 and 31 are duplicate specimens of Nos. 28 and 30.

---

* The result of two analyses closely agreeing.

TABLE 5.—Peruvian Guano imported in the latter part of 1848 and the commencement of 1849.

Number of Specimen	24	25	26	27	28	29	30	31	32	33
Name of Ship. . .									"British Empire." Top of Cargo.	"British Empire." Bottom of Cargo.
Water	13·39	14·47	16·84	14·87	11·96	11·15	16·52	13·27	10·24	10·21
Organic Matter & Salts of Ammonia	52·37	51·62	49·83	52·10	52·84	54·46	51·92	53·07	54·59	55·14
Sand	1·35	1 23	1·17	1·35	1·49	1·40	1·16	2·95	1·42	2·17
Earthy Phosphates	23·29	23·53	24·26	22·83	22·93	23·03	22·22	22·84	21·31	25·30
Alkaline Salts . .	9·60	9 15	7·90	8·75	10·78	9·96	8·18	7·87	12·44	7·18
	100·00	100 00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Ammonia supplied by 100 parts of each Specimen	17·63	16·80	17·48	17·81	17·51	17·15	16·65	17·24	18·37	15·98

The next and concluding series of analyses of this variety of guano exhibits a very great resemblance in composition to those specimens last described.

The five first samples were brought me by the importers, Messrs. Gibbs and Son, No. 35 being a duplicate from the ship Manchester, whose analysis was before given (in Table 2). The samples Nos. 39 to 43 were taken from the respective ships by myself, in the presence of Mr. Lawes and of a gentleman of the firm of the importers. I can therefore vouch personally for their authenticity. The other specimens are, with the exception of specimens 34 and 35, from ships lately arrived in the river.

TABLE 6.—Peruvian Guano imported chiefly in 1849.*

Number of Specimen	34	35	36	37	38	39	40	41	42	43	44	45	46	47
Name of the Ship.......	"British Empire."	"Manchester."	"Parkfield."	"Henrietta."	"St.George."	"Commerce."	"Parkfield."	"Oceana."	"Monarch."	"Wallace."	"Lucy Wright."	"J.T. Ford."	"Prince of Wales."	Ditto, 2nd Sample.
Water	11·94	10·91	12·17	13·12	10·94	11·16	12·78	12·05	10·44	11·20	8·97	10·37	12·13	10·46
Organic Matter and Salts of Ammonia	54·56	52·36	51·68	51·80	53·88	54·32	53·50	53·80	53·51	52·91	57·64	55·73	53·22	55·95
Sand	2·20	2·19	1·60	2·13	2·23	1·22	1·18	1·38	1·39	1·33	1·12	1·20	1·37	1·60
Earthy Phosphates	22·08	22·96	24·08	24·39	23·73	22·19	23·91	24·26	21·28	23·97	23·58	25·20	25·02	28·98
Alkaline Salts....	9·22	11·58	10·47	8·56	9·22	11·11	8·63	8·51	13·38	10·59	8·69	7·50	8·26	3·01
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Ammonia yielded by 100 parts of each Spec.	17·53	7·14	16·82	16·95	17·25	17·18	17·57	16·95	17·27	16·99	18·56	18·94	17·63	17·21

---

* When this table was arranged I was ignorant of the names of some of the specimens, and of their being duplicates of others in the table.

Having now before us the analyses of nearly 50 specimens of Peruvian guano, we may very safely proceed to draw from them some general conclusion as to its *average* composition, and as to the extent of deviation to which that composition is liable. In doing so, perhaps the fairest plan will be to take first into consideration those specimens only which have been obtained directly from the docks.

The Tables 2, 5, and 6, give the composition of 32 specimens, concerning whose history there is no doubt.

The first ingredient to be noticed is the *Water.*—Although to all appearance guano is frequently quite dry, this is not chemically the case. A certain quantity of water is natural to it, being absorbed by the compounds which it contains; and even when taken from the centre of a cargo, and quite dusty in character, guano yet contains about one-tenth part of its weight of water. It has also a strong tendency to absorb moisture from the air, and to this circumstance is due the change of colour which it undergoes when left exposed for a short time.

The drier Peruvian guano is the lighter is its colour; a brown or chocolate tinge is not *necessarily* a proof of inferiority, inasmuch as this colour is often due to its having become accidentally damp. With a knowledge of this disposition to attract moisture from the air, we are not surprised to find the different specimens exhibiting some latitude in the amount of water.

The lowest per centage of water	(Spec. 3)	. is .	8·88
The highest ,, ,,	(Spec. 4)	. ,, .	22·68
The average of 32 specimens being	. . . . .		13·09

It will be observed that those most recently examined (Table 6) are all of them drier than those which were imported at an earlier period. I have no doubt that the excess of moisture in the former is therefore due to exposure since the cargoes were unshipped, and that the average of the 5th and 6th Tables (which is 12·14 per cent.), will express about the real proportion of moisture. The water in guano is of no further interest than as, being of no value itself, it depresses proportionably that of the guano. Thus, for instance, the addition by accident or fraud of 5 or 10 per cent. of water to an originally dry specimen, will be a loss to that amount on the farmer's purchase. At the same time it is to be observed, that some of the wettest of the specimens of guano in the table (as for instance, No. 5), are in no way inferior in the proportion of ammonia, which, as will be presently shown, constitutes its greatest value.

This tendency to absorb moisture is worthy of a passing notice in reference to the action of the manure; for it is often of the greatest consequence in dry seasons.

Organic Matter and Salts of Ammonia.—When dried guano is burned in the open air it loses from one-half to two thirds of its weight; this loss consists of the animal compounds, such as uric acid, &c., and the carbonate and other salts of ammonia. Upon an examination of the tables before referred to, it will be found that under this head—

The lowest per centage (Spec. 7)	is	37·78
The highest . . (Spec. 3)	„	58·82
The average of 32 specimens being		52·61

Although the extreme differences above given really occur in genuine Peruvian guano, the amount of variation is not by any means common. In the 32 specimens, only three will be found having a higher per centage of combustible matter than 56, and about the same number falling short of 50 per cent.

At first sight the proportion of organic matter and ammoniacal salts in guano might seem to be a datum of importance, and so it would be if it were a measure of the ammonia which each sample can supply. Such, however, is not the case. Specimens 1 and 7, which contain very different quantities of organic matter, &c., yield very nearly the same amount of ammonia; and this holds good in many other instances, which will occur to the reader who examines the tables. An analysis of guano therefore, to afford an accurate notion of its value, must state the quantity of ammonia—the proportion of "matters containing ammonia" furnishing no definite information on this point.

Sand, &c.—The proportion of sand in guano is of no great importance. It serves, however, to indicate its purity or otherwise.

In some species of guano a large proportion of sand is found. If the deposit is on the mainland, the sand is introduced into it during its formation by the action of winds; or if on an island of a loose texture, the guano becomes mixed with the surface matter itself.

The genuine Peruvian guano is brought from one or more islands about 6 miles from the coast of Peru, and is deposited on a solid rock. Neither of the before-mentioned agencies therefore come into play, and the manure is consequently almost free from sand or other insoluble substances. In the 32 specimens—

The lowest per centage of sand (Spec. 1)	is	1·17
The highest „ „ (Spec. 31)	„	2·95
The average of all the specimens being		1·54

In the great majority of cases the proportion of sand is found to be within 1 and 1½ per cent. This comparative uniformity of quantity, and indeed the presence of any sand at all, ceases to surprise us when it is remembered that the digestion of birds cannot be carried on without the introduction with their food of a certain portion of some granular substance.

From the fact that amongst the pure specimens of guano now described, one or two may be selected which contain nearly 3 per cent. of sand, great caution is necessary before a specimen is declared to be impure or adulterated, because it contains a larger quantity of insoluble matter than usual ; but there can be no difficulty in coming to this conclusion if a high per centage of sand is accompanied with other unusual characters.

Earthy Phosphates.—It has been before pointed out, that the precipitate which receives this name consists almost entirely of phosphate of lime. Unlike the ingredient which we have just discussed, the proportion of phosphate of lime in guano is of *positive* importance.

The lowest proportion	(Spec. 1)	is	19·46 per cent.
The highest ,,	(Spec. 7)	,,	34·45 ,,
The average of 32 specimens being			24·12 ,,

Here again the exceptional cases are comparatively rare—the majority of specimens affording a proportion of phosphate of lime confined within 20 and 25 per cent.

Alkaline Salts.—It has been explained that under this head are included the sulphates and muriates of potash and soda, together with any loss occurring in the analysis. Of these ingredients the potash is the only one of any importance, as will be more clearly shown presently. The quantity has been ascertained in 16 specimens of guano, and in these it averages 3·64 per cent. It is not, however, to be thought that it always reaches this high proportion—for in some samples the total amount of alkaline salts is so small, as to preclude the presence of any considerable amount of the alkali. In the 16 cases before alluded to, the alkaline salts average 8·13 per cent., of which 3·64 per cent. is potash. We shall not therefore perhaps be far wrong in estimating the potash at something less than one-half of the average proportion of these salts.

In the 32 specimens the alkaline salts are as follows :—

The lowest proportion	(Spec. 6)	is	0·61 per cent.
The highest ,,	(Spec. 7)	,,	13·48 ,,
The average of the 32 specimens being			8·78 ,,

The last number very nearly agrees with that deduced from specimens in which the potash was actually determined, and we shall therefore conclude that the *average* proportion of this alkali is about 3½ per cent.

The Ammonia.—Of all the ingredients of Peruvian guano the ammonia is the one of greatest value, and a knowledge of its proportion in the different specimens is of the highest importance. In the 32 specimens from which the preceding averages have been drawn, we find—

The lowest proportion (Spec. 33) . is .	15·98	per cent.
The highest ,, (Specimens 1 and 45) .	18·94	,,
The average of 32 specimens being . .	17·41	,,

That the above per centage of ammonia is higher than most persons have been in the habit of considering it, I think will be readily granted. The great number of specimens examined, and the period of time during which they have been collected, are however greatly in favour of an uniformity in the composition of *true** Peruvian guano. The character of the guano islands themselves is also an additional argument on the same side. I am informed by a gentleman, who for several years has personally superintended the loading of the guano ships, that the island from which the Peruvian guano is brought, and which is one of a group called the Chincha Islands, is one mass of the manure, having a circumference of 5 or 6 miles.

At the point where the guano is now worked, the height of the deposit is upwards of 80 feet, and the removal of some 200,000 tons has scarcely affected it in a perceptible degree. As may be imagined from the immense weight of the mass, and the gradual way in which it has been formed, its solidity is very considerable, and in some cases it has been necessary to blast it as we would a rock of sandstone or limestone. It will be obvious that in such circumstances the guano would be preserved with little loss. Leaving the further consideration of ordinary Peruvian guano, until we are in a position to enter upon the question of money value, I now pass on to the other known varieties.

There is a variety of guano, of which a few cargoes only have reached England, and which is known in Peru as Angamos guano. It is in no way peculiar, except in being above the average richness in ammonia, and somewhat whiter in colour. It is a deposit of recent formation, being collected by hand, and at considerable expense, from the rocks which the birds frequent—not more than 400 or 500 are annually obtainable.

The following Table exhibits the composition of 4 specimens of this kind of guano :—

---

* I say *true* Peruvian guano, because other varieties, such as the Bolivian and Chilian, are brought from the same part of the world. I have not yet had an opportunity of examining specimens of these kinds of guano, and am not therefore in a position to say whether they are of the same value and exhibit the same uniformity in composition as those above described. The importers are expecting cargoes of Bolivian guano during the present summer (1849), and have promised to supply specimens for analysis, upon which I shall hope to report in a future Journal.

TABLE 7.—Angamos Guano.

Number of Specimen	48	49	50	51
Water	16·29	10·93	15·00	15·00
Sand	3·29	1·56		
Organic Matter and Ammonia Salts	58·84	51·45	59·00	62·50
Earthy Phosphates	14·69	23·04	22·00	18·50
Alkaline Salts	6·89	13·02	4·00	4·00
	100·00	100·00	100·00	100·00
Ammonia from 100 parts	20·07	20·79	20·89	20·40

The Specimens 50 and 51 were analyzed by Dr. Ure. Specimen 49 was purchased by the person who placed it in my hands for analysis in the ordinary way of business from a country dealer. I have no knowledge of its history; but as it closely corresponds with the other samples of Angamos guano, I have ventured to place it side by side with them.

At the same time it is obvious that the difference between this kind of guano and the best specimens of Peruvian is very trifling, since there are in the Tables several cases in which the proportion of ammonia approaches 19 per cent.

We now proceed to the other and inferior varieties, taking them in the order of ammoniacal value. The Ichaboe guano, therefore, naturally presents itself first on the list.

Under this head I can offer no results of my own. The analyses given below were made by Dr. Ure and Mr. Teschemacher.

TABLE 8.—Ichaboe Guano.

Number of Specimen	48	49	50	51	52	53	54	55	56	57	58
Name of the Ship	"Fairy Queen."	"Zephyr."	"Charles."	"Malvina."	"Ocean."	"Malvina" (duplicate).	"Gleaner."	"Empress."	"Zenobia."	"Severn."	"Nereid."
Water	29·5	29·5	26·5	26·5	27·0	26·5	29·5	26·5	24·8	..	..
Animal Matter and Ammoniacal Salts	20·0	33·5	41·0	36·5	42·0	36·5	33·0	35·0	34·0	29·5	36·5
Sand	7·0	1·0	·3	·5	·5	·5	1·0	·5	·3	..	..
Earthy Phosphates	37·0	33·0	28·7	27·5	26·0	27·5	29·5	29·5	30·0	35·5	29 5
Ammonia	4·5	7·5	9·5	8·0	7·5	8·0	7·0	7·3	8·0	5·2	7·7

The relation in composition between the Peruvian and Ichaboe guanos is at once seen: with less than half the proportion of ammonia, the latter contains a slightly increased quantity of earthy phosphate. That the last-named advantage can in no way compensate for a deficiency in ammonia will be better seen when the relative value of these ingredients is ascertained. Of the ammonia—

The lowest per centage in the table is . . .	4·5
The highest ,, ,, . . .	9·5
The average of 11 specimens being . . .	7·3

Of the phosphates of lime:—

The lowest . . . is	26·0
The highest . . . ,, ...	37·0
The average of the whole number being .	30·3

We may by-and-bye find occasion to return to a consideration of this variety; but for the present we pass on to the next analyses, which are those of Patagonian guano.

This variety usually contains more ammonia than the Saldanha Bay guano, although in either case the quantity is very small.

Nos. 66, 67, and 68, are samples taken from the top, middle, and bottom of a cargo respectively, the analyses being by Dr. Ure; 69 and 70 are duplicates of the same cargo; the analysis of 71 and 72 were made in my own laboratory; the remainder are by Mr. Teschemacher.

TABLE 9.—Patagonian Guano.

Number of Specimen	59	60	61	62	63	64	65	66	67	68	69	70	71	72
Name of the Ship . . .	"Commodore."	"John Panter."	"Sancho Panza."	"Tuscan."	"Fifeshire."	"Wm. Bailey."	"Agnes."	"Prince George," Top of Cargo.	Ditto, Middle of Cargo.	Ditto, Bottom of Cargo.	"Doris."	Ditto, (duplicate).	Name unknown.	Name unknown.
Water . . .	24·5	27·0	28·5	26·5	25·5	24·0	32·0	21·0	20·5	23·2	27·0	18·0	29·5	24·8
Animal Matter and Salts of Ammonia	16·5	16·5	17·5	17·5	16·0	16·5	21·0	16·5	12·0	9·5	28·5	30·0	18·6	28·0
Sand	6·5	10·5	9·0	8·5	7·0	2·5	·5	1·0	·5	·2	6·0	7·0	2·7	7·9
Earthy Phosphates	48·0	42·0	41·5	44·0	48·0	53·0	40·5	59·5	65·5	65·2	41·5	32·0	29·3	14·2
Ammonia. .	2·25	2·00	1·60	1·60	1·85	2·00	2·50	2·00	2·00	2·00	3·25	4·00	3·80	4·68

The highest per centage of ammonia is . .	4·68
The lowest ,, ,, . . .	1·60
The mean of the 14 specimens	2·54

Of the phosphate of lime, omitting No. 66, which is so very different from the other specimens,

The highest per centage is	65·5
The lowest ,, ...	29·3
The mean ,, ...	44·6

In this variety of guano we have the state of things reversed; the relative proportion of earthy phosphates and of ammonia is so changed, that the former constitutes the chief value of the manure. Patagonian guano, then, is bought for its phosphates, not for its ammonia, though, of course, the latter is not to be despised. The same is true, in a greater degree, of Saldanha Bay guano.

Saldanha Bay Guano.—Of this description of guano I shall give first the analyses made under my own direction:—

TABLE 10.—Saldanha Bay Guano.*

(Names of Ships unknown.)

Number of Specimen...	73	74	75	76	77	78	79	80	81
Water	19·86	15·27	19·73	26·64	17·92	7·58	18·09	14·40	12·22
Organic Matter and Salts of Ammonia	14·00	23·28	15·59	17·80	13·28	21·69	15·51	13·29	19·64
Sand	3·63	3·07	1·12	·89	7·92	·68	·99	2·26	·99
Earthy Phosphates.....	55·13	49·01	55·00	49·24	58·36	56·99	58·76	60·96	54·82
Ammonia	1·16	2·49	1·48	·94	1·81	2·20	1·88	·96	2·18

We have here arrived at the last step in the series. In this kind of guano the ammonia becomes comparatively insignificant in quantity, and as a natural consequence the proportion of earthy phosphate attains its maximum.

In the 9 specimens described—

The highest per centage of ammonia is . .	2·49
The lowest ,, ,, . .	·94
The mean of the specimens	1·68

Of the phosphate of lime—

The highest number is	60·96
The lowest ,, ...	49·01
The mean ,, ...	55·40

The following analyses of Dr. Ure and Mr. Teschemacher bear out my own results:—

TABLE 11.—Saldanha Bay Guano.

Number of Specimen	82	83	84	85	86	87	88	89	90	91	92
Name of the Ship ..	"Eliza."	"Ralph Bernal."	"Stephen."	"Brunswick."	"Fairy Queen."	"Georgiana."	Ditto, 2nd Sample.	"Achilles."	"Abel Gower."	"Thames."	"Stately."
Water	33·0	32·0	32·0	28·0	25·0	19·0	..	23·0	32·0	18·0	27·0
Organic Matter and Salts of Ammonia	6·0	11·5	12·5	13·0	10·5	19·0	17·5	10·5	10·7	19·0	14·5
Sand	1·5	·5	1·0	·5	·3	2·5	..	1·0	·5	·5	1·0
Earthy Phosphates..	57·0	53·5	51·0	56·0	62·5	61·0	59·5	63·5	54·5	61·0	51·5
Ammonia	..	1·75	2·00	1·50	1·50	1·50	2·10	1·00	1·25	1·50	0·2

The highest per centage of ammonia is . .	2·10
The lowest (omitting 86)	1·25
The mean of 9 specimens (also omitting 86) .	1·56

---

* For some detailed analyses of this variety of Guano, see Appendix.

A number which does not differ greatly from that deduced from the last series of analyses.

The highest per centage of phosphate of lime is	63·5
The lowest " " " "	51·0
The mean of 11 specimens	57·4

Exhibiting also a tolerably close resemblance to that of the other analyses, and furnishing satisfactory proof of the trustworthiness of both sets.

As a summary of the preceding analyses it may be interesting to give here the average proportion of ammonia and phosphate of lime contained in the different varieties which have been examined.

The ammonia is as follows:—

In Peruvian Guano	(32 specimens)	17·41 per cent.
Ichaboe	(11 specimens)	7·30 "
Patagonian	(14 specimens)	2·54 "
Saldanha Bay	(20 specimens)	1·62 "

The phosphate of lime in the same number of specimens:—

Peruvian Guano	24·12 per cent.
Ichaboe	30·30 "
Patagonian	44·60 "
Saldanha Bay	56·40 "

In these figures are interestingly apparent the changes which have occurred in the varieties which originally (that is to say, as deposited by the birds) were, in all probability, nearly identical. Every ton of Saldanha Bay guano may, indeed, be regarded as having originated from two or more tons of Peruvian, from which fermentation and rain have removed the greater part of its ammoniacal compounds.

Having now at our disposal the analyses of a great many specimens of the different varieties of guano, we are in a condition to apply our knowledge to the question of their money-value. It is, however, to the Peruvian guano that the reader's attention will be principally directed; for although a certain limited quantity of the other varieties is still in the market, it is understood that no great supplies are henceforth to be expected, except in the case of the Peruvian guano. It is highly satisfactory to hear that the *mountains* of the latter are practically inexhaustible.

A knowledge of the composition of the inferior kinds will, however, prove useful, not only as exhibiting the points of relation between composition and the public appreciation which fixes the selling price, but as furnishing data for the calculations upon which we are about to enter.

Our present object is, by an examination of the different commercial sources of the fertilizing ingredients in guano, and of the cost at which they can be supplied in this or that compound—to establish a standard value for each of these—and, having done so, to apply it to the composition of Peruvian guano. It is hoped that, independently of the specific purpose to which it is directed, this inquiry may not in itself be devoid of interest to the agricultural reader.

It has been stated more than once in the course of this paper that the ammonia, the earthy phosphates, and the mineral alkali, potash, are the only *important* ingredients in guano. I say *important*, because, without denying the use of sulphate of lime and of common salt as agents of vegetation, I am prepared to show that the cost of their separate purchase is so trifling as to prevent us from attaching any considerable *pecuniary* value to the small quantities of these substances existing in guano.

The present is the proper place to discuss this point; and by eliminating from the question those minor details which will not materially influence the general results, the inquiry will be greatly simplified.

After setting aside the ammonia (present or to come), the earthy phosphates, and the potash, what else is there in guano deserving of our attention? Referring to Table, No. 1, we find mention made of "water and sand,"—these are ingredients of no value; again, of "magnesia and oxide of iron,"—but in quantity inconsiderable; and also of "sulphuric acid,"—but in no case exceeding 4½ per cent., and giving us in 8 cases a mean of 3·82 per cent.

A ton of guano will, therefore, contain on an average 85½ lbs. of sulphuric acid; a quantity which would be supplied by about 185 lbs. of gypsum. Gypsum can be bought in any quantity at 15*s*. or 20*s*. a ton.* Assuming the latter as a fair price, and that 1 ton of Peruvian guano contains on an average sulphuric acid equal to 1¾ cwt. of gypsum; then the outside allowance which we can make for this ingredient is 1*s*. 8*d*. or 2*s*. in a ton of the guano.

It has been before stated upon what grounds we have adopted this principle of calculating the value of each ingredient according to the cheapest form in which it can be supplied.

Upon reference to the Table we find the alkali soda existing partly as common salt and partly in other forms of combination.

The mean per centage of common salt is .	1·82
And of soda in its other salts . . .	1·14

If we assume that on an average in Peruvian guano this alkali occurs to the extent of 4 per cent. of common salt, that is to say,

---

* The price of native gypsum is, I believe, somewhat higher than that above stated. The calculations above rather refer to *sulphate of lime*, which, as a refuse product in the manufacture of tartaric acid, stearine candles, &c., may be had in abundance at the price named.

that 4 lbs. of common salt would furnish all the soda of 100 lbs. of guano, we shall not be far from the mark.

This quantity in a ton of guano would amount to about 90 lbs., or a little more than ¾ cwt.; since common salt may be in most places bought for 30*s.* a ton or less, the sum of 1*s.* 3*d.* is quite enough to allow for all the soda compounds in a ton of Peruvian guano.

These two items, of 2*s.* for gypsum and 1*s.* 3*d.* for common salt, constitute the entire addition which requires to be made to the value of the three staple ingredients.

Small though the sums are, it is very fair to take account of them in comparing guano with other manures; but it would be absurd to allow them to complicate the present discussion.

Having disposed of all other claims to our attention, we will now endeavour to ascertain the relative value of the principal ingredients of guano. It will be obvious that we must look beyond guano itself for any help in this undertaking; for although eventually it may be very interesting to observe how far its selling price approaches to the united *average* value of its constituents, it would be manifestly impossible without external evidence to affix to each of these a fair share of pecuniary importance. It is to external evidence that we must first look for a decision of this particular.

It may probably be convenient to begin with phosphate of lime, for it has been shown that the earthy phosphates so frequently mentioned almost entirely consist of this substance.

In addition to Peruvian guano itself, there are three principal sources of phosphate of lime available for agricultural employment—

Bones in their various states;

The mineral phosphates known as coprolites;

And the lower priced guanos, such as the Saldanha Bay and Patagonian varieties.

It seems odd to draw any argument from the last source, particularly as the supply of phosphatic guano has well nigh ceased, but some assistance may be derived from such a proceeding. Whilst, however, we are discussing the relative economy of phosphate of lime obtained from different sources, it must never be forgotten that phosphate of lime, agriculturally considered, is not always, if we may so speak, phosphate of lime; that is to say, it may in one case be very different in its action on vegetation to what it is in another, dependent upon the extent of its solubility and other circumstances. In putting a price upon the earthy phosphates of guano, we must select for our guidance that source of phosphate of lime which exhibits the nearest resemblance in these essential particulars. For reasons which will presently be apparent, the mineral phosphate will be first considered. Leaving out of the question the great bed of Estremadura phosphorite, which at present is not of sufficiently ready access to prove of any practical importance to British agriculture, there are two chief supplies of mineral phosphate of lime in England—the phosphoric nodules or "coprolites" of the "crag" beds, and the somewhat similar deposits in the "green-sand" formation.

The former has up to a late period stood alone in practical importance, and it yet remains to be seen whether the phosphoric strata of the chalk and green-sand will at any future time offer a more available supply of phosphate of lime. We may shortly consider both of these sources.

The coprolites of Suffolk occur in rounded lumps and masses in a shelly gravelly soil, and in many places very near the surface. They are separated from the gravel by an easy process of sifting.

These coprolites are sold *in London,* with a profit to the collectors, at about 30*s.* a ton.

To grind them into a tolerably fine powder (and as they are intensely hard, this operation requires very powerful machinery) a further expense of from 15*s.* to 20*s.* a ton is incurred. It is probable that the ground coprolites could not be sold at a much lower rate than 3*l.* a ton. But it is to be remembered that the coprolites are not entirely composed of phosphate of lime; on the contrary, not much above one-half of them consists of this substance.

The average proportion of phosphate of lime in the coprolites is 56 per cent. A ton of them contains therefore 1332 lbs., and by an easy calculation it will be found that a ton of *phosphate of lime* as supplied by ground coprolites will cost 5*l.* 9*s.* 1*d.*, which is at the rate of 100 lbs. for 4*s.* 10*d.*, or rather *more* than ½*d.* for each pound of phosphate of lime.

Turn we now for a minute to the other deposit of mineral phosphate of lime.

At the junction of the green-sand with the gault clay are conglomerated masses or nodules, of various sizes and forms, made up of phosphate of lime and sand. These have been fully described in the Journal of the Society, vol. ix., part i.

I am not aware that these remains have been collected in any quantity for sale, and at present any conjectures as to their cost must necessarily be open to much error. Mr. Paine, who has dug 50 or 60 tons for his own use, has found them to cost him in labour, when delivered at his farm by his own men and horses, about 15*s.* a ton.

These are not nearly so hard as those of the crag, and would probably not cost so much to grind. Let us suppose that they could be collected and sold, as in the other case, *ground* at 2*l.* a ton, which at first sight appears a considerably cheaper rate than the Suffolk kind.

They contain on an average only 42½ per cent. of phosphate of lime: from this source a ton will consequently cost 4*l.* 14*s.* 1½*d.*, at the rate of 4*s.* 2½*d.* for 100 lbs., or as nearly as can be ½*d.* a lb.*

Allowing for all imperfections in these data, we shall perhaps not be far wrong if we fix the cost of phosphate of lime derived from mineral sources at ½*d.* a lb.

But the argument is by no means complete at this point; it is not to be supposed that the substance in question, as found in the coprolite, or green-sand fossils, is equal in solubility, and therefore to be ranked in value with that contained in guano. From the fact that, in the latter case, it is derived from the pulpy excrements of birds (deposited centuries ago, indeed, but preserved comparatively unchanged) we should be disposed to give it a high place in the scale of solubility, whilst a glance at the mineral substance would convey the very opposite impression.

My own belief is, that of the two varieties of mineral phosphates, *simply ground*, the green-sand variety would prove the most energetic upon vegetation; but I am bound to say that it would be an error, in the present state of our knowledge, to place either of them in competition in this respect with the earthy phosphate of guano. It will occur to the reader that there are means of rendering phosphate of lime *soluble*, and thus enabling it to equal and far even to exceed the same substance as supplied by guano. In superphosphate of lime we are familiar with phosphate of lime so prepared and rendered soluble, and it might be interesting to inquire at what cost we can purchase it in this soluble and unexceptionable form.

From calculations, which need not be here introduced, I believe that phosphate of lime, as supplied by "superphosphate," is bought at a price varying from 1½*d.* to 2½*d.* per lb., according to the mode in which the so-called superphosphate is manufactured. This substance, however, has, from its solubility, a specific action on the turnip crop which would hardly seem to be equalled by any other form of phosphate of lime, and it is therefore of very little use to place it in comparison with that of guano. Of one circumstance, however, we may rest assured, that phosphate of lime in any form cannot be worth *more* than about

---

* Since the above was written, Mr. Paine has informed me that he has this year dug a quantity of these phosphoric nodules at a much less expense. If at any particular spot a bed of them should be found within a foot or two of the surface, and running parallel to it, I believe that it would well repay the expense of working, but hitherto the nodules have been found in strata which, although tolerably horizontal themselves, are only accessible at the outcrops on the edges of undulating ground.

2*d.* a lb., since it can be bought at this price in a perfectly soluble condition; that it has less than half this value will presently appear.

Thus far the argument has been extremely simple: it is quite easy to fix a price upon the phosphate of lime derived from mineral substances, because their entire value is referable to it; but the cost of this substance in bones or in guano is of more difficult decision, because in the latter cases a second element is introduced into the calculation; in bones, for instance, there are two chief sources of agricultural value—the *gelatin*, or nitrogenous matter capable of yielding ammonia, and the earthy phosphates. We must establish the money value of the one before we can calculate the cost at which we purchase the other.

Not to anticipate the argument which will be adduced when speaking of ammonia, it may be sufficient in the present place to observe that ammonia may be bought, in a fit state for agricultural use, and in almost unlimited quantity, at something under 6*d.* a lb.

Raw unboiled bones contain* 6·00 per cent. of nitrogen, which, when converted by decomposition into ammonia, would furnish about 7·3 per cent. of the latter ingredient. Upon this presumption 1 cwt. of bones will eventually furnish 8 lbs. of ammonia. In the following calculations the price of raw and *crushed* bones is estimated at 5*l.* 10*s.* a ton, or 5*s.* 6*d.* a cwt. If the whole quantity of ammonia which bones can gradually furnish existed in them, or was capable of being supplied by them as readily as it is by guano, then it would be quite fair to calculate it at the price just now named, that is to say, at 6*d.* a lb. But it is not so; there is reason to believe that bones will remain in the ground a great length of time unaltered, and, valuable as is the prolonged action of the animal matter, it seems necessary to make a considerable reduction for the tardiness of its action when compared with that of ammonia. If we are allowed to deduct one-fourth of the whole sum on this ground, then 4½*d.* a lb. will be the price of ammonia as so furnished. It should be clearly understood that this sum is only fixed by way of argument, and to assist in setting a value on phosphate of lime; when the latter point has been satisfactorily determined, the argument may be reversed, and brought to bear again upon the value of ammonia in bones.

At 4½*d.* a lb. the 8 lbs. of ammonia supplied by 1 cwt. of bones will be worth 3*s.* To the oil or fat of bones we cannot well ascribe any agricultural value; opinion is divided as to its agency as manure, but there is very little doubt that bones are better rather than worse for its removal—a circumstance, however, which does not set the question at rest; however this may be, the am-

---

* See Appendix.

monia being worth 3*s.*, the remaining 2*s.* 6*d.* will here be considered as the cost of the phosphate of lime of 1 cwt. of bones.

100 lbs. of bones contain 50 lbs., and 1 cwt. therefore 56 lbs. of phosphate of lime. 2*s.* 6*d.* for 56 lbs. will give us rather more than ½*d.* per lb. as the price of the earthy phosphates of bones. It is obvious that these two ingredients must bear the cost between them, and that, if we diminish the one, we must increase the other in like proportion; thus, if we take 6*d.* a lb. as the ammonia value of bones, the price of the earthy phosphates will be reduced to one-third of a penny per lb. The sum of ¾*d.* per lb. seems a very fair price to fix for the earthy phosphates of bones, and as such it will be provisionally adopted. It now remains to calculate by the same rule the cost of phosphate of lime in the cheaper varieties of guano.

In Saldanha Bay guano we buy both ammonia and phosphates; the former, however, in small proportion only. Taking for our guide the averages given at p. 211, we find that Saldanha Bay guano contains as a mean—

Earthy phosphates .	55·00 per cent.
Ammonia	1·68 ,,

Saldanha Bay guano sells at from 4*l.* 10*s.* to 5*l.* a ton, more usually the latter sum. The provisional price of 6*d.* a lb. for ammonia, as before, will give the sum of 18*s.* to be deducted, leaving the sum of 4*l.* 2*s.* as the price of 1232 lbs. of phosphate of lime, being at the rate of 100 lbs. for 6*s.* 7¾*d.*, or a little more than ¾*d.* per lb. In the preceding calculation the value of the guano has been calculated with reference only to ammonia and phosphate of lime, potash or other ingredients being left out as needlessly complicating the question.

Reviewing the subject of the last few pages, we find that the approximative value of phosphate of lime ranges between ½*d.* and ¾*d.* a lb.

Ammonia.—In endeavouring to fix the money value of ammonia we must expect to meet with still greater difficulties than in the case of the phosphates; for whilst of the latter there are several sources from whence a liberal and economical supply can be drawn, it is really as a source of ammonia, pre-eminently so, that guano possesses so high a manurial value; and, consequently, any attempt to attach a money value to the ammonia of guano, in reference to that contained in other recognised manures, presupposes a degree of similarity in the economy of the substances thus placed in competition, which is far from existing. Nevertheless, it will be found that even in the case of guano the selling price is to a certain degree in accordance with what it should be were the substances which it contains to be furnished separately and from various sources. Leaving, however, the further development of this point for the present, we shall proceed to examine the existing sources of a supply of ammonia for agricultural use.

The different salts of ammonia, as the bicarbonate (the common smelling salts), the muriate (known as sal-ammoniac), and the sulphate, are all to a considerable extent articles of commerce, being in one way or another employed in the arts or in medicine. The first of these, however, is not at present sufficiently cheap to be profitably employed in practical agriculture.

Many years ago the sources of ammonia were extremely limited, and its salts were correspondingly dear; but, by the general introduction of gas, an abundant quantity of this alkali has been opened out. It is very commonly known that, amongst the other products of the distillation of coal in the ordinary process of preparing gas, a large quantity of an ammoniacal liquor is obtained, and many who read this paper may have made use of it as a manure under the name of "gas-liquor." The origin of this liquid is very simple. In all samples of coal which have been examined with a view to detect it, nitrogen has been found in variable proportion, derived evidently from the plants from which the coal has been formed. When the coal is heated the nitrogen is converted into ammonia, which collects in the "condensers" principally as carbonate or hydrosulphate. By the addition of mineral acids and subsequent evaporation any desired salt of ammonia can be produced.

The sulphuric is of all other acids that which is most valuable in the arts, and, as its very numerous applications have led to great perfection in the manufacture of this acid, it is under most circumstances the only compound of its class which is economically applicable. Accordingly, large quantities of sulphuric acid have been used in the preparation of sulphate of ammonia from the ammoniacal liquor of the gas-works.

Muriatic acid is a refuse product in the preparation of carbonate of soda, and under some circumstances it is employed in the preparation of an ammoniacal salt from gas-liquor with more economy than the sulphuric.

Sulphate of ammonia costs from 11*l.* to 12*l.* per ton, and no inconsiderable quantity has been sold as manure at this latter price. The muriate varies in price between 17*l.* and 21*l.* per ton. Whether these salts can, with a profit to the manufacturer, *at present* be prepared at a lower price, I cannot say; but as, by that mutual dependence of the arts of life which meets us at every turn, the gas-works of England are destined some day, and probably before long, to become auxiliary to the production of food by supplying the farmer abundantly and cheaply with ammonia, it may not be out of place here to state the reasons for the obviously high price of the salts in question.

We have just now stated that coal-gas, as it is discharged from the mouths of the retorts in which the coal is heated, is unfit for consumption, being contaminated, amongst other things, with hydrosulphate and carbonate of ammonia. To get rid of these compounds, which would render the gas more or less impure, the manufacturer has recourse to some method of purification. For the sulphuretted hydrogen he employs lime, which retains the largest portion of the noxious gas. The ammonia is in great part deposited in the cooling apparatus or condensers. Both of these processes of purification are a source of considerable annoyance and trouble in the preparation of gas, and for the separation of the ammonia in particular the want of some perfect method has long been felt. Many chemical substances have been proposed for the purpose, but as yet no method has been found which should both purify the gas without injury to its quality and at the same time afford an economical supply of ammonia for agricultural purposes. The object in view would, at first sight, appear of most ready accomplishment by means of a mineral acid, so arranged that it should abstract the ammonia from the gas in its passage from the retorts. With this view the gas has been passed through sawdust or other porous substances moistened with sulphuric acid, by which a perfect separation of the ammonia has been obtained. But, unfortunately, it appears that the success of this process, on the one hand, is entirely neutralized by an unlooked-for objection. It is found that the illuminating power of the gas is very greatly impaired by its contact with the sulphuric acid, a result which has of course led to the abandonment of the method.

The sulphate and muriate of ammonia of commerce are for the most part made from the ammoniacal liquids of the gas-works; and to the evaporation and other manipulations necessary to obtain the salts in the dry state is chiefly to be ascribed their high price. That such is the case will be clearly seen by examining the composition of these salts.

Sulphate of ammonia (see note in Appendix) contains, when perfectly pure and *dry*,

Ammonia	22·7	per cent.
Sulphuric Acid	53·3	,,
Water	24·0	,,

This water is, as the chemical reader would understand, water of composition or crystallization, and its existence is perfectly compatible with the salt being *dry*. But it is not to be expected that a salt prepared on the large scale should be perfectly pure, and it will be necessary to allow 10 per cent. for moisture and accidental impurity.

The sulphate of ammonia of commerce will contain in 100 parts and in a ton respectively—

	In 100 parts.	In a ton.
Ammonia	20·4	457 lbs.
Sulphuric Acid	48·0	1,075 ,,
Water	31·6	708 ,,
	100·	2,240 ,,

Here it will be seen that to procure 1 ton of ordinary sulphate of ammonia about ½ ton (dry) sulphuric acid must be employed. Sulphuric acid which has not undergone the final and expensive evaporation—that is to say, acid of specific gravity 1·70 (see note in Appendix)—can be bought for about 5*l.* a ton. According to the calculation in the Appendix below, the quantity of such acid necessary to form a ton of sulphate of ammonia will be worth 3*l.* 14*s.* 4½*d.*

	£.	*s.*	*d.*
Deducting from the value of a ton of sulphate of ammonia	12	0	0
The value of the acid used in its preparation	3	14	4½
We have	8	5	7½

as the value of the ammonia in a ton of the salt, leaving out, of course, in this case all calculation of the cost of labour, &c.

From the above facts it would appear that a high value was placed upon the ammonia by the gas-manufacturer; but, in truth, it is not so. As a product of very secondary importance in relation to that of the gas itself, it is not usually worth his while to embarrass his operations with its preservation; whilst, on the other hand, he views the difficulty of its removal as an imperfection of his process, and would liberally encourage any improvement which could be suggested. We can only then conclude, that of the 12*l.* a ton paid for sulphate of ammonia, 8*l.*, or two-thirds of the sum, represents the expense of manipulation.

Again: the sum of 3*l.* 14*s.*, as the expense of the acid, suggests the desirableness of discovering some comparatively inexpensive substance for the absorption of the ammonia. There is good reason to hope that the ingenuity and industry of those who apply themselves to these manufacturing processes will sooner or later be rewarded by the discovery of an economical means of separating the ammoniacal compounds without injury to the illuminating power of the gas itself; and then, and not till then, will this source of ammonia assume the importance which it merits.

If we assume that in sulphate of ammonia the only ingredient of value in an agricultural point of view is the ammonia, its price will be 6¼*d.* per lb. It may be fairly objected to this mode of calculation, however, that the sulphuric acid is of some value as manure, and that the whole cost should not be thrown upon the ammonia. In a ton of sulphate of ammonia there are 1075 lbs. of sulphuric acid, which would be supplied by about 20¾ cwts. of gypsum, at a cost of 16*s.* 1½*d.* If, therefore,

	£.	*s.*	*d.*
From the cost of 1 ton of sulphate of ammonia .	12	0	0
Is deducted the agricultural value of its sulphuric acid	0	16	1½
	11	3	10½

will be the expense of the ammonia, or rather more than 5¾*d.* per lb.

From the preceding calculations it will be evident that we shall not greatly err in fixing 6*d.* per lb. as the value of ammonia, as supplied by the sulphate at its present price of 12*l.* a ton.

Muriate of ammonia contains, when quite pure and dry, 31·6 per cent. of ammonia. I am unable to say what quantity of water and impurity it may usually contain in its crude state, but it may be sufficiently near for the present purpose to estimate this at 10 per cent.: accordingly, crude commercial muriate of ammonia will have about 28 per cent. of ammonia.

Taking its *average* value to be 19*l.* a ton, and, without any allowance in this case for the acid, the price of ammonia in the muriate will be 7¼*d.* per lb. At 17*l.* a ton the ammonia would cost about 6½*d.*; and at 21*l.*, rather more than 8*d.* per lb.

It remains now to inquire what is the cost of ammonia in its other available sources. The importation of *oilcake* into a farm must be looked upon as an indirect importation of ammonia. In feeding his stock with oilcake the farmer increases the quantity, and, in a greater proportion, the quality of his manures; and every ton of cake thus consumed is equivalent to the purchase of a certain quantity of ammoniacal manures.

What relation in value the manure so produced (or imported) may bear to the cost of its importation it is not the purpose of this paper to inquire, nor is the question to be very readily settled. The value of a ton of oilcake regarded as *manure* is obviously dependent upon the proportion of its original cost, which may be fairly placed to the account of profit in feeding with it.

Leaving the discussion of this subject to a more fitting place, we may simply calculate the value of ammonia as supplied by oilcake, considered only in a manurial point of view. The market price of oilcake is so variable, that no actual sum can be fixed upon as its average cost; we shall therefore make a calculation for the *extreme* of fluctuation.

From the analyses of a great many specimens examined in my laboratory, I find that the average proportion of nitrogen in oil-cake is 4·6 per cent. The proportion of phosphoric acid and of potash furnished by a ton of oilcake, although worthy of consideration under other circumstances, is too small to affect to any considerable extent the present calculations (see note in Appendix). At 4·6 per cent. a ton of oilcake will contain 103 lbs. of nitrogen, capable of becoming 125 lbs. of ammonia. Taking oilcake at 6*l.* 10*s.* a ton as a low price, and 11*l.* as the other extreme, the ammonia will cost as follows:—At 6*l.* 10*s.* a ton the ammonia will cost 1*s.* 0½*d.* per lb.; at 11*l.* a ton the ammonia will cost 1*s.* 9*d.* per lb. Considered, then, in the light of manure *only*, oilcake must at its minimum price be a dear source of ammonia.

Rape-cake is as nearly as possible of the same composition as linseed-cake, its cost being, however, only from 4*l.* to 5*l.* a ton. At 4*l.* 10*s.*, the mean of these numbers, ammonia as supplied by rape-cake would cost about 8¾*d.* per lb.

Of the price of ammonia as derived from bones we have before incidentally spoken. From this source a supply of ammonia will be obtained at a price ranging between 4½*d.* and 6*d.* per lb., according as the value of phosphate of lime is estimated at ½*d.* or ¾*d.* per lb. As the latter sum has been shown to be a fair price for the earthy phosphates, it may be assumed that ammonia is bought rather more cheaply in bones than in sulphate of ammonia, but with the essential difference that in the case of bones the ammonia has to be formed—we must wait for it. How great an advantage this is in favour of the *ready-made* (so to speak) ammoniacal manures in certain soils, those readers who rightly estimate the value of *time* in relation to practical agriculture will easily perceive.

There are yet other sources of ammonia within the reach of the farmer; and it might be thought that these should be referred to as a guide to its money value. Woollen rags, clippings of skins, parings of horns and hoofs, dried blood, seal-skins, &c.—all or any of them may under peculiar circumstances with great advantage be employed by the farmer. As, however, the supply of such refuse substances is limited, and as, for want of the more uniform demand which an unlimited supply would infallibly create, the price is a matter of perfect caprice, it would be unsafe to draw any very general conclusions from the imperfect data so obtained: individuals may and *do* buy these nitrogenous substances for manure with great advantage to themselves, but the community of agriculturists could not do so.

We shall reserve the question of the cost of ammonia in *guano* itself until we have fixed the price of potash—the only remaining datum needed for ascertaining the value of different specimens of the manure in question.

Whatever opinion the reader may entertain of the value of *potash* as a direct application to the soil—whether he may think it highly important, or may deem it unnecessary or productive of no beneficial results, still it becomes any individual who shall attempt to fix a money value on a compound manure like guano to be prepared with a price which shall approximate to the commercial value of all the important ingredients. It will be at the option of the reader to allow or disallow the value which is thus attached.

Potash is supplied commercially by four principal salts:—carbonate of potash, known as *potashes* or *pearlashes;* nitrate of potash, or *nitre*; muriate of potash; and sulphate of potash.*

In the first of these (the carbonate), potash is bought at from 5*d.* to 6½*d.* per lb., according to the varying market-price of the salt.

In nitrate of potash we shall buy potash at 6¾*d.* per lb.

Sulphate or muriate of potash will, however, furnish us with this alkali at the rate of 2¼*d.* per lb.

The wide difference in price between the two former and two latter sources is due to the circumstance that the nitrate of potash is more valuable in commerce for its combination with nitric acid than for the potash itself, and the carbonate for its adaptation to the purposes of an alkali. In the sulphate and muriate we have the real value of the potash, these being both refuse salts.

With a knowledge of the approximative value of its three important ingredients, our attention may now be turned to the money value of guano itself;—this being the only object of all the preceding calculations. It has been seen that the average composition of Peruvian guano is the following:—

Ammonia	17·41	per cent.
Phosphate of lime . . .	24·12	,,
Potash	3·50	,,

Taking ammonia at its price as supplied by the sulphate—that is to say, at 6*d.* a lb.; phosphate of lime as it may be bought in bones or Saldanha Bay guano, at ¾*d.* per lb.; and lastly, valuing

---

* The market value of the different salts of potash is far from constant. For the calculations above, I have made use of the following prices, which perhaps will be sufficiently correct:—

Carbonate of potash, from 28*s.* to 42*s.* a cwt.
Sulphate, 12*s.* a cwt.
Muriate, 13*s.* ,,
Nitrate, containing 90 per cent. of real nitre, 28*s.* per cwt.

The per centage of potash in these different salts, when *pure and dry*, is as follows:—

Carbonate . .	68·2	
Sulphate . . .	54·0	
Muriate . . .	63·2	(or *potassium* equal to this quantity of potash).
Nitrate . . .	46·7	

potash, as we find it in the sulphate and muriate, at 2¼*d.* per lb.: what will be the value of a ton weight, of an average specimen of Peruvian guano? The calculation is not difficult:—

	£.	*s.*	*d.*
The ammonia, at 17·41 per cent., amounts to 388 lbs., which at 6*d.* a lb. is worth	9	14	0
The phosphate of lime, at 24·12 per cent., amounts to 540 lbs., which at ¾*d.* is worth	1	13	9
The potash, at 3½ per cent., amounts to 78½ lbs., which at 2¼*d.* per lb. is worth	0	14	8
Which together give .	12	2	5

as the value of all the ingredients of a ton of good Peruvian guano. I think it highly important that the above calculations should not be misunderstood. There may be many persons who would buy Peruvian guano *solely for its ammonia;* although not unwilling to enrich their soils with the phosphate of lime which accompanies it, they would object to purchase the latter at the price set against it in the table. There is indeed no absolute proof of the advantage of always applying these two manures in the proportion in which they exist in guano: take the instance of a farmer who is in the habit of manuring liberally with bones or superphosphate of lime for his root crop;—it is quite conceivable (although the case is only put here for argument sake) that in any subsequent application of guano he would be using this substance only as a source of ammonia. In this case he could only afford to pay for it on its ammoniacal merits. Even in such a case Peruvian guano will compete with advantage with sulphate of ammonia at its present price; for with guano at 10*l.* a ton the purchaser will buy ammonia at the same price as in the sulphate, and will get the phosphate of lime and the potash for the extra 6*s.*

The preceding observations apply even more strongly to potash, for which some readers will be inclined to allow no money value whatever. It is impossible for me to meet the different views which may be entertained on these points. It is sufficient that those who disallow any items in the above calculation can readily make for themselves any alteration they may think fit.

With its present composition Peruvian guano would seem to bear a fair market price. Whether a reduction in price might not remunerate the importers by a greatly increased sale it is impossible, of course, to say; but there can be no doubt that, if it could be effected, such a measure would confer an inestimable boon on the agricultural interest of this country.

With the view of showing the farmer how great a loser he is by the purchase of an inferior or adulterated guano, I will here place in contrast with the average value of good guano, an estimate of that which is to be ascribed to an adulterated specimen. No. 23 in the 4th Table will furnish such an example:—

	£	*s.*	*d.*
The ammonia 8·12 per cent. amounts to 182 lbs., which at 6*d.* per lb. is worth	4	11	0
The phosphate of lime 21·09 per cent. amounts to 472 lbs., which at ¾*d.* per lb. is worth	1	9	6
The potash at (say) 3½ per cent. amounts to 78½ lbs., which at 2½*d.* per lb. is worth	0	14	8
Giving	6	15	2

as the value of a ton of this specimen of guano.

Although those who are familiar with the characters of a good guano would, from an inspection of the specimen, be led to a doubt of its possessing the full ammoniacal value, there is nothing striking or peculiar in its appearance, and nine-tenths of the purchasers of the manure would receive it without suspicion. It is only by chemical analysis that this point can be decided. The farmer's only safety in the purchase of guano is in the character of the dealer from whom he obtains it, or in the knowledge of its composition as determined by analysis.

Of the money-value of Saldanha Bay guano I have already incidentally spoken (page 218).

Its selling price closely approximates to what it should be were the phosphate of lime and ammonia calculated in the same way as in Peruvian guano.

It cannot, however, be too often remarked, that the value of these two varieties of guano is of an essentially distinct character. It will not do to suppose that, because they are sold at a fair price in relation to their composition, they may be employed indifferently, and that 10*l.* spent in one will be employed to the same advantage in the other. If the object of the agriculturist is to make use of an ammoniacal manure, he will not attain that object by the purchase of Saldanha Bay guano. On the other hand, if he seeks to add phosphate of lime to his soil, the use of Peruvian guano would be a most expensive method of doing so. Without therefore attempting to point out the exact circumstances in which it would be advisable to apply the one or the other, it is right that it should be distinctly understood that they are by no means to be used indifferently.

APPENDIX AND NOTES.

1. *On the Sampling of Guano.*—In taking samples for analysis the following plan was followed:—When taken from the ship, a complete mixture of the guano from several parts of the cargo, to the extent of perhaps half a cwt., was made in the vessel itself. From this heap a quantity of 2 or 3 lbs. was removed to the laboratory for analysis. If the cargo was in the warehouses, the mixture was made from the centre of several bags which were cut open for that purpose. In the selection of the sample, if a lump of any sort should occur, appearing to bear too large a proportion to the whole mass, it is rejected.

To prepare the guano for analysis, the sample of 2 or 3 lbs. is made to pass, by rubbing in an iron mortar, through a wire sieve of 40 holes to the square inch; it is afterwards thoroughly mixed by continued rubbing in the mortar. From the mixture so made a quantity of about an ounce is separated, and carefully powdered in an agate mortar. This last forms the subject of the analysis.

In the course of the analyses which are given in this paper many cases have occurred tending to prove that a sample of guano taken in this way fairly represents the bulk from which it is separated. One or two instances may be mentioned. In Table 3 the specimens 12 and 13 are duplicates. No. 12 was taken from two or three bags; No. 13 was a mixture of portions taken from more than 100 bags. By an inspection of the Table it will be seen that the differences between the two samples are by no means large. In Table 6 are two specimens of "Parkfield" (36 and 40.) These samples were taken at different times, but closely resemble each other.

Then again, in Table 5, specimens 28 and 29, as also 30 and 31, are duplicates. A glance at the analyses will show that they are very much alike, although the samples were taken at two different periods during the unloading of the cargo.

In order to ascertain to what extent the different parts of a sample of guano would possess a difference of composition, I made the following experiment:—A mixture of many different specimens of Peruvian guano which had from time to time reached the laboratory, and in the same state as when taken from the ships, was sifted successively on sieves of 40 and 20 holes to the inch. In this way three separate samples of different degrees of fineness were obtained:—

No. 1, passing the 40-hole sieve.
No. 2, passing the 20, but retained by the 40-hole sieve.
No. 3, which was too large to pass either.

In the latter the lumps, which were tolerably hard, were of various sizes, some being as big as pigeons' eggs. The three siftings were separately powdered and partially analysed, with the following results:—

	Water.	Organic Matter, &c.	Ammonia.
No. 1.	11·19 per cent.	53·42 per cent.	17·28 per cent.
No. 2.	12·19	54·94	not ascertained
No. 3.	11·00	53·93	16·40

This experiment affords very strong evidence in favour of a great amount of uniformity, even where small specimens only are compared. It shows that the white lumps are really only agglomerations of the smaller particles, and that indeed they are no richer than the latter. This remark only applies to Peruvian guano. In some varieties of guano which are naturally very wet, all sorts of collections and crystallizations have been found, and it excites no surprise that such should be the case; but the experiment just described strengthens the opinion which would be formed from a knowledge of the circumstances under which Peruvian guano has been produced, and which is, that no amount of separation and rearrangement of the particles could have occurred since its deposition. In "damaged guano," on the other hand, it is easy to trace a crystallization of its salts brought about by the water.

2. *On the Methods of Analysis.*—First as to drying the specimen. In all our earlier analyses of guano the samples were dried before the combustion for nitrogen. It was soon found that this drying could not be effected in the ordinary way. Even at the temperature of the air guano always emits ammonia; and at 212° the quantity of ammonia is so great as to produce a loss of 2 or 3 per cent. sometimes in the subsequent analysis. To obviate this defect we had recourse to the use of an acid in the drying. A specimen of the guano in a shallow platinum dish was treated with a few drops of hydrochloric acid, which was allowed to soak through the whole. It was then dried at a water-bath heat without loss, and in the subsequent analysis the presence of the acid had no influence.

We have subsequently found that a moderately dry specimen of Peruvian guano—that is to say, containing not more than 15 per cent. of water—can be mixed with the soda-lime for nitrogen analysis with perfect safety, without drying, provided the soda-lime itself be perfectly dry. The mixture is made in the tube by the help of a corkscrew wire, and no smell of ammonia can be detected.

In the detailed analyses given in the first Table the substances were separately determined in the same way as the ash of a plant is analysed. One modification of the usual process deserves notice. In burning guano to obtain the mineral part for analysis, a considerable loss of chlorine and sulphuric acid occurs from the escape of these substances in the form of ammoniacal salts. To ascertain the total quantity of the chlorine and sulphuric acid, it is necessary to saturate the guano with a strong solution of potash or soda, which in the subsequent burning retains the acids in question.

The following comparison of the corrected and uncorrected results will show the extent of loss due to this cause:—

SULPHURIC ACID.	A	B	C	D	E	F	G	H
Uncorrected result .	·79	trace	1·45	2·76	1·09	1·06	1·74	2·24
Corrected result . .	3·83	3·47	4·00	4·54	4·57	4·00	3·60	2·52
CHLORINE.	A	B	C	D	E	F	G	H
Uncorrected result .	·09	none	none	·12	·33	·96	·65	·20
Corrected result . .	·57	1·46	1·56	1·62	1·36	1·35	·79	·97

The determination of the actual quantity of these ingredients necessitates also a correction for the quantity of organic matter as ascertained by burning. In the analyses which are given, in all the tables but the first, the method of examination was as follows:—

The guano is dried at a water-bath heat and afterwards burnt; the ash is dissolved in hydrochloric acid, and the solution filtered to separate sand. The earthy phosphates are precipitated by ammonia. This precipitation of the earthy phosphates does not give a perfect determination of the phosphoric acid; for, besides the phosphates of lime and magnesia, which have the composition of bone-earth, there is in guano more or less of the phosphates of potash and soda. The addition of ammonia does not always cause a very uniform precipitate of phosphate of lime, the phosphoric acid of the potash salt being more or less carried down with the salt of lime. Phosphoric acid is therefore sometimes present in the liquid after this precipitation. For ordinary commercial purposes the result is, however, sufficiently accurate.

The nitrogen analysis is conducted in the usual way, the guano being burnt with soda-lime and the resulting salt of ammonia weighed as the double platinum salt. Of the accuracy of this method there can be no doubt, but it may be satisfactory to mention some cases where the analysis of a specimen has been repeated with confirmatory results. Two nitrogen analyses were made of specimen 14 in the third table:—

1st analysis gave	16·46 per cent. of ammonia.
2nd „	16·75 „

Two analyses of specimen 16:—

1st analysis gave	16·93, per cent. of ammonia.
2nd „	16·70 „

Two of specimen 34:—

1st analysis gave	17·37 per cent. of ammonia.
2nd „	17·69 „

Two of specimen 36:—

1st analysis gave	16·79 per cent. of ammonia.
2nd „	16·85 „

Two of specimen 37:—

1st analysis gave	16·97 per cent. of ammonia.
2nd „	16·93 „

Very many other instances could be adduced to show that the results of two analyses are the same, which in such cases is tantamount to a proof of correctness in both. The duplicate analyses, specimens 34, 36, and 37, were made by different persons, and are therefore more than ever satisfactory.

3. "*Damaged Guano.*"—It is not unusual for a cargo of guano to suffer from the action of the water by leakage in the vessel. If the quantity of water thus entering is not great, it is absorbed by the outer portions of the guano, that in the centre escaping altogether. The importers set aside this portion, which is sold, according to its degree of wetness, at a reduced price.

The following are the proportions of water and ammonia in two specimens of damaged guano sent to me by the importer:—

	Water.	Ammonia.
1st Specimen, ship "Commerce" . . .	80·68 per cent. ..	12·62 per cent.
2nd „ ship unknown	33·13 ..	15·71

By a calculation based upon the analysis of a sound specimen of the cargo of the "Commerce," given in Table 6, it will be seen that the deterioration in value of the specimen is only slightly greater than to the extent of the proportion of water thus added to it. There is, however, an *absolute* loss, which is due to the escape of ammonia with watery vapour, a fact which is always observable to the smell in guano ships which have suffered leakage.

4. *Saldanha Bay Guano.*—The following are more detailed analyses of four specimens of this variety of guano. The specimens are before described in Table 10:—

	Spec. 78.	Spec. 79.	Spec. 80.	Spec. 81.
Water	7·58	18·09	14·40	12·22
Organic Matter and Salts of Ammonia	21·69	15·51	13·29	19·64
Sand, &c.	·68	·99	2·26	·99
Earthy Phosphates	56·99	58·76	60·96	54·82
Excess of Lime	3·70	2·23	1·07	·57
Carbonic Acid	2·61	·68	·20	3·08
Sulphuric Acid	1·94	1·31	4·09	2·57
Chlorine	·73	·55	·72	·57
Magnesia	·68	·86	·20	·32
Potash and Soda, and Loss	3·40	1·02	2·81	5·22
	100·00	100·00	100·00	100·00

This table serves to point out that in Saldanha Bay guano, although the potash has not been actually determined, it is, in all probability, in less quantity than in the Peruvian variety.

5. *Nitrogen in Bones.*—The estimate in the text is thus derived: bones are supposed to contain 33 per cent. of gelatin, which, according to Scherer, contains 18·32 per cent. of nitrogen; 100 parts of bones will therefore contain about six parts of nitrogen.

6. *Sulphuric Acid, of specific gravity* 1·70.—This is the cheapest form in which sulphuric acid can be purchased. When first produced, this acid is diluted with much water, which is driven off by subsequent evaporation. The evaporation is effected, in the first instance, in leaden vessels, and afterwards when the acid, becoming concentrated, begins to act on the lead, it is transferred to vessels of platinum or glass. The expense of this process is so great as materially to enhance the value of the acid. The farmer does not require the acid of full strength, and it would be frequently far better for him to purchase this dilute acid, which for a certain sum contains a larger amount of acid. The expense of carriage will sometimes interfere with his doing so.

7. *Potash and Phosphoric Acid in Oil-cake.*—From several analyses of the mineral ingredients of oil-cake, I find that 1 ton would contain about 43 lbs. of phosphoric acid and 32 lbs. of potash, which at the prices before given would be worth together only about 11*s.*

XII.—*On the Construction of a Pair of Cottages for Agricultural Labourers.* By HENRY GODDARD, Architect and Surveyor, of Lincoln.

FIRST PRIZE-ESSAY.

THE leading features of this communication being the plans, specification, and estimate, and as the views of the author are clearly defined therein, it is his intention as concisely as possible to confine his observations to an explanation of them, recording at the outset that no reference has been made to any published work, and that to a long residence in one of the most important agricultural districts in the kingdom is he indebted for his acquaintance with the subject. In preparing the accompanying plans it has been his—

Object.—To attain at the smallest cost the greatest amount of comfort and convenience in the construction of suitable residences for the large majority of the *bonâ fide* agricultural labourers. In effecting this, it has been his desire to avoid excess in cost and size, and the sacrifice of interior comforts for the sake of pictorial effect. It has also been his aim to avoid if possible the creation of facilities to induce the tenant to "let off" a portion of the rooms which are designed for the exclusive use and due classification of his own family.

Situation, Aspect, Soil, &c.—Such a variety of circumstances, both natural and local, have to be considered in determining upon sites for the erection of labourers' cottages, that the adoption of any fixed rules seems almost impracticable. It may not be amiss, however, to suggest that a plot of land abutting upon, and at a level of from two to four feet above a good road, forming part or being in the immediate vicinity of an allotment of land available for spade husbandry, and possessing facilities for efficient drainage, seems most desirable; and in all cases care should be taken that the habitation of the labourer is not too remote from the locality of his daily avocations. The aspect should be south, or as nearly so as can be obtained, and the value of the situation would be enhanced if protected on the north and east from the inclemency of the weather, but the close proximity of forest trees should be avoided as having a tendency to deteriorate the value of the garden ground, and in the autumn to clog up the gutters and spouts of the cottages with dead leaves. A good soil of easy cultivation, with a substratum of gravel or sand, is essential, or (when the prevailing prejudices are overcome) a piece of used-up old grass-land, sufficiently elevated for draining purposes, would not be unsuitable.

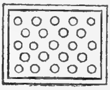
Exterior Arrangements.—The cottages are proposed to be built in pairs, and should be placed at a distance of five or six yards from the road, leaving a small space for the cultivation of flowers, herbs, and the smaller kinds of garden produce; and the good feeling which it is desirable should exist between the occupants, is most likely to be secured by rendering them as independent of each other as circumstances will permit. With this view a separate entrance is made to each, and in the minor arrangements the pump only is used by both tenants. If further separation is desired, it may be accomplished by planting a privet fence between the two in front, and a post and rail fence at the back, and making the pump with a double handle to work both ways.

The author conceives it to be objectionable to make the entrance-door fronting the road, not only on account of its publicity, but because an indolent tenant is in the habit of throwing the ashes and other refuse matters into a heap immediately before the doorway, owing to its remoteness from the rear of the house. In the plan it will be seen that a receptacle has been provided within an easy distance of the door, to render such a practice unnecessary and inexcusable.

Interior Arrangements.—As the surest preventative of the house becoming a residence for two families, and as being more consonant with the wants and means of the labourer, one living room only is provided, which is approached by a small porch for the sake of privacy and warmth. The fireplace is recessed in the wall, and leaves an available space for household purposes of 13 feet by 11 feet in the clear (being equivalent to 13 feet by 12 feet 6 inches where the chimney-breast and cupboard project into the room). The window is designed with a small recess on each side to receive fall-back shutters. The only door (except the outer one) in the living room communicates immediately with the staircase, scullery, pantry, and coal-place. The scullery is 8 feet 6 inches by 7 feet in the clear, and is fitted up with a boiling-copper and stone sink. Another external, or "back door," and a second fireplace in the scullery are purposely omitted for the reasons before mentioned. If it is deemed advisable to have either one or the other, the former may be placed between the pantry and coalplace, and the latter beside the copper in the scullery. Neither of these alterations are recommended; another door would make the living room much colder, and, under any circumstances, the cooking required for a labourer's family is never of such magnitude as to require two fireplaces, or to render the living room even in summer (when the fire is seldom used except morning and evening) so hot as to be unhealthy. Immediately contiguous to, but apart from the living room and scullery is a convenient pantry, the floor of which is intended to be 16 inches below the level of the others, leaving sufficient height for suspending bacon and other provisions from the joists above, and permitting a bench to be placed at the end nearest the porch to receive milk and other articles requiring a cool temperature. In addition to a sufficiency of shelves, a cupboard is proposed to be fixed at a height of three feet above the bench for the safe custody of such articles as are usually deposited in a similar convenience beside the fireplace in living rooms of cottages. The upper story is divided into three separate bed-rooms, and from the mode of construction adopted, a larger amount of space is secured to these rooms than low walls and high pitched roofs would permit. The height of each room is 8 feet, and the dimensions are—No. 1, 11 feet by 10 feet; No. 2, 11 feet by 7 feet 6 inches; and No. 3, 8 feet 6 inches by 7 feet, containing 860, 645, and 469 cubic feet respectively. One room only (the largest) is provided with a fireplace, which will be found quite sufficient both for ordinary and extraordinary occasions. One might be placed in every room if required, without deranging the plan. A convenient closet is obtained at the top of the stairs, and another in a recess adjoining the fireplace in Bedroom No. 1.

The Out-Offices.—It is very objectionable to make these indispensable adjuncts form part of the cottage itself; and equally offensive to good taste (if isolated) to have such a primitive outline as indicates most unmistakeably their respective uses. In the plan the two extremes are avoided, and a situation is selected within easy reach of each cottage, and they are so contrived as to conceal as much as possible the purposes for which they are designed. Within the enclosure accommodation is made for keeping a pig, and where such a practice is not interdicted, it is better to build a suitable place, than leave the tenant to exercise his ingenuity upon old wood and thatch, and supply the deficiency in a manner most offensive to the eye, and prejudicial to the health of those around him.

Materials, Construction, Supply of Water, &c.—A difficulty arises here in laying down rules for universal adoption; the geology of the district, local customs, and the facilities of transit may interdict it; the author has, however, endeavoured to hit the rule rather than the objection, by suggesting as the most applicable—brick for the walls, Baltic timber for the carpenter's work, and Welsh slate covering for the roofs. It must be distinctly understood notwithstanding, that any variation in the materials will not affect the general arrangements. All the window-frames are proposed to be of wood as being more economical and agreeable than iron or stone, and the squares not being large, the outlay for renewal in the event of breakage will be so trifling as to offer no inducement for the occupant to substitute a piece of old newspaper for a square of glass. The eaves of the cottages project for the sake of appearance and better security of the walls. The water from the eaves on the south front is conveyed into the drain leading from the sinks in the sculleries, by which means any refuse will be effectually washed away at every fall of rain, and on the north side a sufficiency of water may be collected in water-butts (for the use of the tenants) placed against the outer walls of the staircases. The hard water pump (communicating with a well) is placed against the back wall of the cottages exactly central between the two, and the waste water therefrom will communicate with the drain; in districts where the springs are at a considerable depth below the surface the well may be dispensed with, and a water-tight tank substituted, into which the water from all the eaves should be conveyed.

Warming and Ventilating.—To ensure the carrying out of these essentials to a poor man's comfort, simplicity and economy must be borne in mind, consonant with which and being at the same time more agreeable to the habits and customs of Englishmen, open fireplaces are recommended, viz., "Nicholson's improved Cottage Range" for the living room, and a small sham stove for the bed-room fireplace. Iron or lead pipes, heated by hot air, water, or steam, however effective they may be in operation, form but a poor substitute for the cheerful fire, however small, which is most agreeable to the sight and pleasant to the feelings of an agricultural labourer after a cold wet day's work. The living room and bed-room No. 1, having each a door, window, and chimney opening (considering their capacity also), have sufficient facilities for ventilation. The scullery is ventilated by the insertion of an air-brick  in the outer wall; the pantry by similar means, one air-brick being built in the wall beneath the seat of the porch, and another at the opposite end under the floor-joists above; the two smaller bed-rooms to have a perforated wood ventilator  in each ceiling, and an air-brick in each gable above the ceiling on the north and south fronts.

Cost.—In the following calculations bricks are supposed to be worth 30*s.* per thousand, lime 12*s.* per chaldron of 32 bushels, and sand 3*s.* per ton; the estimate may therefore be deemed a maximum one, and may be reduced in every instance where landed proprietors make their own bricks, and the lime and sand are procured upon the estate. The substitution of stone in districts where it is abundant and easily worked would effect a considerable saving, and a further reduction may also be effected in the items of timber and carriage, where plenty of the former is available and the latter is not a matter of consideration:—

Note.—Although this essay was considered the best, it is not of course recommended by the Society as giving a *perfect* plan. The out-offices seem open to several objections. The height of the surrounding wall would render the enclosure very offensive, unless the privies as well as pig-pounds were constantly cleansed. The pig-pounds are too confined, especially the sheds, the form of which is not good. The privy doors should not be opposite each other.—CHICHESTER.

The depression of the pantry-floor would be inconvenient when it is washed, and I should prefer a south-west aspect.—J. F. BURKE.

SPECIFICATION AND ESTIMATE

Of the several Works required to be done in the erection of a pair of Labourers' Cottages.

Diggers' and Bricklayers' Works.

	Rods.	yds.	ft.		s. d.	£.	s.	d.
The necessary excavations to be made for the foundations of the several walls and pantries, the soil to be well rammed down to the walls as they are carried up, and the surplus to be levelled round the outside as may be directed . .	0	20	0	Cube digging foundations	0 5	0	8	4
The whole of the bricks required to be sound, hard, square, and well-burnt kiln bricks, those for external facings to be selected for their hardness and evenness of surface. The bricks for the weatherings and splays to be moulded to the proper forms. The mortar to be composed of well-burnt lime and clean sharp sand in approved proportions, well mixed upon a clean hard floor.								
The whole of the brickwork to be laid in old English or Flemish bond, with close joints, every third course being heading bricks, every course to be well flushed with mortar, and the exterior to be well pointed and jointed	7	86	0	Superficial reduced common brickwork . .	9*l.*	65	17	4
The upper course of the strings, chimney shafts, and copings to be bedded and jointed in Roman cement . . .	0	70	0	Lineal top course in cement	*s. d.* 0 2	0	11	8
The chimney flues to be 10 inches square in every part, the turns and gatherings being made as easy and smooth as possible, and the insides to be well pargetted with prepared mortar		..		Flues measured solid	..			
The jambs and arches of the living-room fire-places to be built with stock bricks in fine mortar, leaving sufficient projection to receive the plastering		..		Extra to 2 chimney-breasts	5 0	0	10	0
The walls of the sculleries, pantries, and coal places to be pointed and twice lime-washed		..		Pointing and whitewashing	..	0	10	0
The bricklayer is to find labour and materials for setting a range in the living-room, copper and sink in the scullery, and sham stove in bed-room No. 1 in each cottage.		..		Setting 2 kitchen ranges	6 0	0	12	0
				Do. 2 coppers	7 6	0	15	0
				Do. 2 stone sinks	4 0	0	8	0
				Do. 2 sham stove	3 0	0	6	0
				Carried over . .	..	69	18	4

Diggers' and Bricklayers' Works—continued.

	Rods.	yds.	ft.		s.	d.	£.	s.	d.
				Brought over	..		69	18	4
The steps to the pantries to be of common bricks on edge, and the floors of pantries, sculleries, and coal-places to be paved with common bricks flatwise; the floors of the porches, living-rooms, and staircases to be laid with the best local paving-bricks, bedded and jointed in mortar				No. 2 brick steps on edge	2	0	0	4	0
	0	19	0	Superficial common brick flat paving	1	3	1	3	9
	0	40	0	,, pavor brick flooring	2	0	4	0	0
A brick bench to be formed in each pantry, covered with paving tiles, bedded and jointed in Roman cement	..			No. 2 brick benches	..		0	7	0
							75	13	1

THE OFFICES.

The same stipulations as to materials and manner of executing the works described for the House are to apply equally to the Offices.

	Rods.	yds.	ft.		s.	d.	£.	s.	d.
Proper excavations to be made for the ash-places, privies vaults, and drains	0	14	0	Cube digging	0	5	0	5	10
A well to be sunk between the cottages and the offices (to be calculated at 5 yards deep), 3 feet 6 inches in diameter in the clear, steined with brick, and domed over at the top with a man-hole left therein, having a flag-stone cover with flush ring let in	0	5	0	Lineal well sinking and steining	10	0	2	10	0
				No. 1 flag-stone cover with flush ring let in	..		0	5	0
The whole of the brickwork to be pointed and jointed on both sides	1½	0	0	Superficial reduced brickwork	9*l.*		13	10	0
					s.	d.			
The floors of the ash-places, vaults, and privies to be paved with common bricks, laid flat, and the pigsties with stone pitching	0	8	0	,, common brick flat paving	1	3	0	10	0
	0	15	0	,, stone pitching	1	6	1	2	6
Small drains of tiles laid in tempered clay and jointed with cement, laid at a depth of eighteen inches below the surface to take the waste water from the sink and pump. These drains to be calculated at 30 yards in length for the two cottages, and any excess beyond that quantity to be paid for as extra	0	30	0	Lineal tile drains	1	0	1	10	0
							19	13	4

Mason's Works.

	Ft. in.		s. d.	£. s. d.
The steps to the porches to be of tooled Yorkshire or other hard stone, 4 inches in thickness and 12 inches wide	0 8 0	Lineal 12 by 4 tooled steps	1 0	0 8 0
The window sills to be 3 inches thick and 9 inches wide, properly weathered and throated	0 31 0	,, 9 by 3 window sills	1 0	1 11 0
A tooled stone hearth and back hearth to be laid to each sitting-room fire-place	0 20 0	Superficial tooled hearths	0 9	0 15 0
A rubbed stone sink, 3 feet by 1 feet 8 inches, to be fixed in each scullery with a brass stench-trap let therein, and brick on edge tunnels to convey the water therefrom into the drains on outside the wall	0 10 0	,, 5-inch rubbed sinks	1 6	0 15 0
		No. 2 brass stench-traps and letting in	3 6	0 7 0
A 2½-inch round-nosed stone seat to be built in the walls of each porch as they are carried up	0 15 0	Superficial 2½-inch tooled seats	0 9	0 11 3
				4 7 3

At the Offices.

				£. s. d.
A 6-gallon stone trough to be provided and fixed to the pump, and a small feeding-trough to each pigsty.		No. 1 6-gallon trough	. .	0 5 0
		,, two small troughs	. .	0 7 0
A stone cover to each vault.		,, two stone covers to vaults	. .	0 12 0
				1 4 0

Slaters' and Plasterers' Works.

	Squ. ft. in.		s. d.	£. s. d.
The roofs to be covered with the best Bangor ladies' slating on 1½ by ¾ Petersburgh red wood laths; to have 2½-inch lap, and each slate to be secured by two copper nails, the under side being well pointed with lime and hair	11 75 0	Superficial ladies' slating	22 0	12 18 6
The ridges to be covered with the best ridge-stone, or Staffordshire tiles	0 66 0	Lineal ridge cresting	0 6	1 13 0
The lime for the plasterers' works to be of the best quality, the sand clean, sharp, and well washed, and the laths stout single fir laths.		Carried over	. .	14 11 6

Slaters' and Plasterers' Works—continued.

	Yds.	ft.	in.		s.	d.	£.	s.	d.
				Brought over . .	. .		14	11	6
The ceilings of the upper story to be lathed, plastered, and set fair; and the walls of the same, with those of the living rooms, to be rendered and set fair	72 220	0 0	0 0	Superficial lath, plaster, and set . . . . „ rendering on walls	1 0	0 6	3 5	12 10	0 0
The quarter partitions in the chamber story to be lathed and plastered on one side, and pane-drawn on the other . .	41½	0	0	„ lath and plaster, and pane-drawing .	1	6	3	2	3
The floors of the chamber story to be run with plaster on laths, 5 pecks to the superficial yard, and to be two coats pane-drawn underneath	62	0	0	„ plaster floor and pane-drawing . .	2	9	7	15	6
A chamfered skirting, 5½ inches deep, to be run in cement round the living rooms, finishing flush with the plastering upon the walls	0	78	0	Lineal 5-inch cement skirting	0	3	0	19	6
						£	35	10	9

At the Offices.

	Squ.						£.	s.	d.
The roofs of privies and pigsties to be covered with slating as before described	1	20	0	Superficial ladies' slating	22	0	1	4	7

Carpenters' and Joiners' Works.

	Squ.	ft.	in.		s.	d.	£.	s.	d.
All the timber to be that known as the best middling Memel, the deals Archangel or Petersburgh red deal, and the whole to be sound, well-seasoned, and free from large and dead knots, or other defects.									
Sufficient centering to be provided for all apertures requiring them		..		No. 8 small centres	0	6	0	4	0
A tier of bond timber, 4½ by 2½ inches, to be laid throughout all the walls, to receive the timbers of the chamber floor, and to be connected through the chimneys by strong iron hooping	0	187	0	Lineal 4½ by 2½ inch deal bond	0	2½	1	19	0
Lintels 3 inches in thickness, and the breadth of the wall to be supported, to be laid over all internal apertures, with 6 inches' wall hold at each end; and a sufficiency of wood bricks to be inserted to receive the door and window linings .	0	22	0	Cube fir in lintels and bricks	2	6	2	15	0

The floors of the chamber story to be of thorough joists wrought and chamfered; those over the sitting-rooms, pantries, and porches, to be 7 by 2 inches, and over sculleries and staircases 5½ by 2 inches	0	336	0	Lineal 7 by 2 inch wrought joists	0	3	4	4	0
	0	168	0	,, 5½ by 2 inch ,,	0	2½	1	15	0
The roofs to be framed with four pair of lock couples and other timbers of the following scantlings, viz.:— Principals . 4½ by 3 in. Cross-ties . 7 by 1¼ in. Wall plates . 4½ ,, 3 ,, Purlins . 5½ ,, 3 ,, Ridge-board . 5½ ,, 1 ,, Rafters . 3 ,, 2 ,, Valley rafters 7 ,, 1½,,	10½	0	0	Superficial lock couple roofing	25	0	13	2	6
The valleys to be lined with ¾ deal 9 inches wide on each side, and the gutters to the chimneys to be laid with ¾ deal on proper bearers	0	63	0	,, ¾-inch valley boards	0	3	0	15	9
	0	10	0	,, ,, gutter boarding and bearers	0	6	0	5	0
A ¾-inch beaded facia, 4½ inches wide, to be fixed to all the eaves and gables	0	146	0	Lineal 4½ by ¾ inch beaded facia	0	3	1	16	6
The bedrooms to be ceiled with joists 3 by 1¾ inches, notched into the rafters underneath the purlins	3	90	0	Superficial ceiling floors	10	0	1	19	0
The quarter partitions are to have 2½ by 1¾ inch wrought and chamfered studs, cross-braced where necessary	3	10	0	,, quarter partitions	10	0	1	11	0
All such timbers as may be requisite to complete the several works which may not be expressly described, are to be of the same relative strength as those specified; and all straps, ties, dogs, or other ironwork necessary to the firm construction of the carpenters' works to be included in the contract		..		No. 4 pairs dogs to roofs	2	0	0	8	0
All the doors to have 1¼-inch rebated casings, of sufficient width to stop the plastering	0	120	0	Superficial 1¼-inch rebated linings	0	6	3	0	0
The entrance-doors to be 1½ inches thick, framed, cross-braced, and covered with 7-8ths boarding, hung with 16-inch cross-garnet hinges, and secured by a 9-inch stock-lock, one 9-inch barrel-bolt, and Norfolk latch upon each door.	0	36	0	,, 1½-inch framed and braced doors	0	10	1	10	0
				No. 2 pairs 16-inch cross garnets	1	6	0	3	0
				,, 2 9-inch stock-locks	2	6	0	5	0
				,, 2 8-inch barrel-bolts	1	0	0	2	0
				,, 2 Norfolk latches	1	3	0	2	6
The remaining doors of the cottages to be 1¼-inch four-panel square-framed, and hung with 3-inch butt hinges; and each door to have a 4-inch boxed spring latch, with bolt fixed upon it, except to the pantries, which are to have 6-inch rim locks, and the doors to coal-places brass turn-buckles	0	170	0	Superficial 1¼-inch four-panel square framed doors	0	9	6	7	6
				No. 13 pairs 3-inch butts and screws	0	6	0	6	6
				,, 9 ,, 4-inch spring latches	1	0	0	9	0
				,, 2 6-inch iron rim locks	2	6	0	5	0
		..		,, 2 brass turn-buckles	0	6	0	1	0
The dimensions of all the doors, when finished, are marked in the respective openings upon the plans in red ink.				Carried over	..		43	6	3

Carpenters' and Joiners' Works—continued.

					s.	d.	£.	s.	d.
				Brought over	..		43	6	3
All the windows to have solid deal frames, with oak sunk and weathered sills, and 1½-inch ovolo sashes; the single-light windows, and one light in each of the others, to be hung with 2½-inch butts, and secured by a suitable fastener	0	146	0	Superficial Yorkshire windows	0	9	5	9	6
				No. 14 pairs 2½ butts and screws	0	5	0	5	10
		..		,, 14 hasps and staples	0	4	0	4	8
The windows of the living-rooms to have ¾-inch ledged shutters, hung with T hinges, and back laps to fold into the recess on each side, and to be secured by 18-inch spring bar and 6-inch bolt to each window; ¾-inch plain linings, and 1-inch window-boards, to be fitted in each recess	0	51	0	Superficial ¾-inch ledged shutters	0	6	1	5	6
				No. 4 pairs T hinges, 4 ditto back-laps	..		0	4	8
				,, 18-inch shutter-bars	1	6	0	3	0
				,, 2 6-inch bolts	0	6	0	1	0
	0	15	0	Superficial ¾-inch plain linings	0	5	0	6	3
	0	6	0	,, inch window-boards	0	7	0	3	6
Three-quarter inch beads, to be fixed round the doors and windows of the rooms described to be plastered	0	360	0	Lineal ¾-inch beads	0	1½	2	5	0
Three-quarter inch square skirting, 3½ inches wide, to be fixed round bed-rooms No. 1	0	78	0	,, 3½ by ¾-inch plain skirting	0	2½	0	16	3
The staircases to have inch rounded treads and ¾-inch risers on strong carriages, inch beaded stringboard and facia, 3-inch newels, 2-inch rounded handrail, and inch-square balusters	0	90	0	Superficial inch treads and rises, with newels, hand-rails, &c., complete	1	0	4	10	0
A ¾-inch ledged, cupboard front 4 feet high, to be fixed across the end of each pantry; and a similar one to the recess beside the fireplace in each bed-room, with suitable hinges and fastenings	0	47	0	Superficial ¾-inch ledged cupboard fronts	0	6	1	3	6
				No. 6 pairs 2-inch butts and screws	0	5	0	2	6
				,, 4 cupboard locks	1	0	0	4	0
				,, 4 cupboard bolts	0	6	0	2	0
Twenty-five feet superficial of inch deal shelves upon proper bearers, to be fixed to the pantries and closets of each house, as may be directed	0	50	0	Superficial inch shelves and bearers	0	6	1	5	0
A small ventilator, 12 by 9 inches, of inch deal, perforated with 12 holes 1¼ in. diameter, to be fixed in the ceiling of each small bed-room in such part as may be directed		..		No. 4 small ventilators	1	6	0	6	0
Plain wood margins to bed-room fireplaces		..		,, 2 plain margins	2	6	0	5	0
							62	9	5

At the Offices.

	Squ.	ft.	in.		s.	d.	£.	s.	d.
The roofs over privies and pigsties to be lean-to roofs, with timbers of scantlings as before described	1	10	0	Superficial lean-to roofs	20	0	1	2	0
The doors to the privies to be ¾-inch ledged, hung with 14-inch cross-garnets to 1¼ rebated stiles. A 4-inch bolt to be fixed upon each door	0	22	0	,, ¾-inch ledged doors	0	6	0	11	0
	0	22	0	Lineal 5½ by 1¼ inch rebated casing	0	3	0	5	6
				No. 2 pairs 14-inch cross garnets	1	3	0	2	6
				,, 2 4-inch bolts	0	6	0	1	0

The privies to be fitted up with inch seat and front boards on proper bearers, and the walls of the ash-place to be covered with chamfered capping, dovetailed at the angles and tied into the walls	0 22 0	Superficial inch seats, rises and bearers	0 6	0 11 0
	0 14 0	Lineal chamfered capping	0 4	0 4 8
The pigsties to be divided by strong oak slab fencing on proper rails, and the doors to be formed of the like materials, and hung with hooks and bands to sawn posts, and secured by hasps and staples	0 36 0	Superficial oak fencing and rails	0 6	0 18 0
		Two pairs hooks and bands	2 0	0 4 0
		Three sawn oak posts	1 6	0 4 6
		Two hasps and staples	..	0 0 8
The pump to have oak standards and top, and inch beaded boarding	..	One pumpcase	..	0 12 0
				4 16 10

Smiths' and Ironfounders' Works.

			s. d.	£. s. d.
To provide 6 cast-iron air-bricks for each cottage	..	No. 12 cast-iron air-bricks	0 9	0 9 0
Provide a 24-inch iron pan, with door and furnace-bars complete, for each scullery; a 38-inch improved kitchen range (manufactured by Nicholson of Newark) for each living-room, and a 20-inch sham-stove for 1 bed-room in each house	..	„ 2 24-inch furnaces complete	20 0	2 0 0
		„ 2 38-inch kitchen ranges	42 0	4 4 0
		„ 2 20-inch sham-stoves	5 0	0 10 0
The eaves in the recesses of the north and south fronts to have 3½-inch cast-iron half-round spouting, securely fixed to the feet of the rafters, and 3 tiers of 2-inch descending pipes, with cistern-heads and discharge-shoes to convey the water therefrom, as shown in the elevations.	Ft. in. 0 33 0	Lineal 3½-inch eaves-spouting	0 6	0 16 6
	0 32 0	„ 2-inch descending-pipes	0 8	1 1 4
		No. 3 heads, 3*s.*; 3 shoes, 2*s*	..	0 15 0
		„ 3 bends	3 0	0 9 0
				10 4 10

Plumbers', Glaziers', and Painters' Works.

			s. d.	£. s. d.
The valleys and chimney-gutters to be lined with 5 pounds lead 18 inches wide, and to be flashed with similar lead	4½ cwts.	Of lead, including laying	24 0	5 8 0
All the windows to be glazed with good seconds glass in putty, and to be left clean and perfect at the completion of the works	Yds. ft. 0 100	Superficial, seconds glass in putty	0 6	2 10 0
		Carried over		7 18 0

Plumbers', Glaziers', and Painters' Works—continued.

	Ft.	in.		s.	d.	£.	s.	d.
			Brought over . .			7	18	0
The floor-joists to be stained brown with boiled oil and umber, and the joiners' and iron-work usually painted to have three coats of good oil colour, finished stone colour inside and chocolate outside, the woodwork being previously well knotted and stopped.	70	0	„ staining brown	0	2½	0	14	7
	108	0	„ 3 coats in oil, common . . .	0	5	2	5	0
			Fourteen windows, 3 coats, 2 sides . . .	2	6	1	15	0
						12	12	7

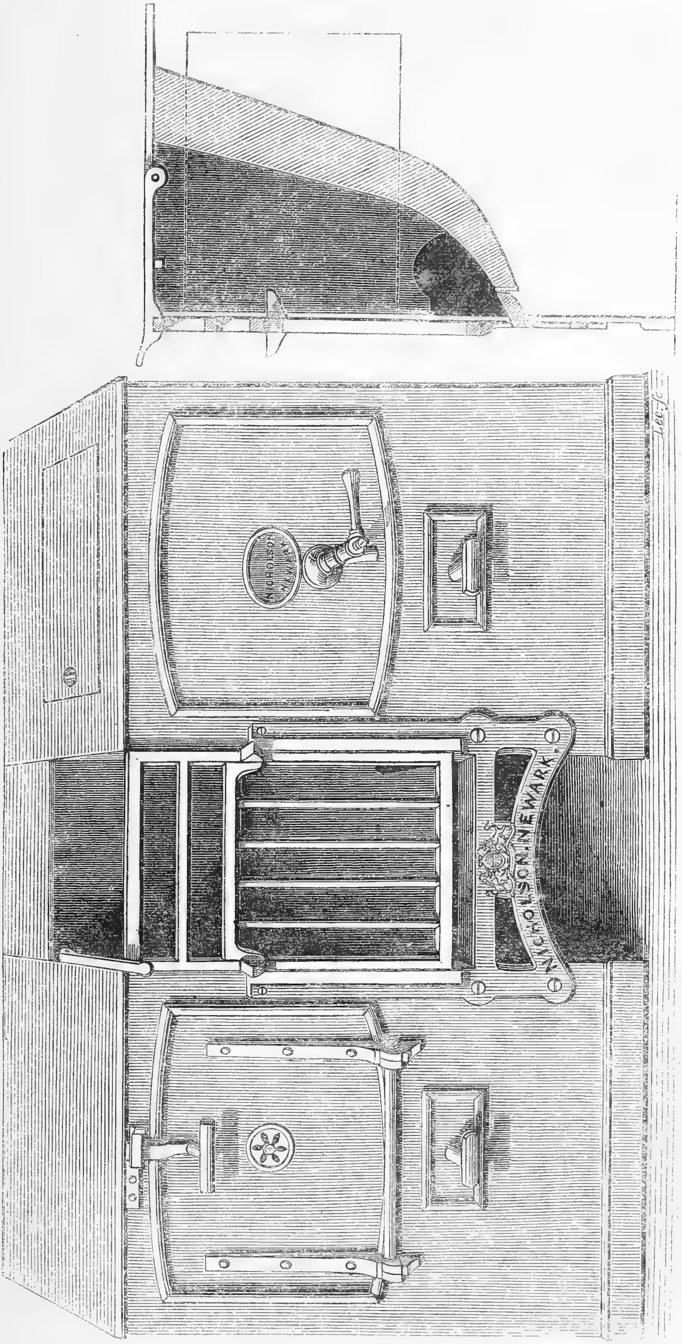
At the Offices.

	Yds.	ft.		s.	d.	£.	s.	d.
A lead suction-pump, to be fixed as shown, with strong working-barrel $1\frac{3}{4}$-inch suction-pipe, calculated at 7 yards in length, and the necessary bucket, sucker, and ironwork complete .	..		No. 1 suction-pump	..		2	5	0
The doors and casings of the privies to be painted three coats, and the pumpcase also	10	0	Superficial 3 coats painting	0	5	0	4	2
						2	9	2

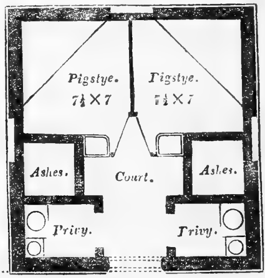
Summary of Estimate.

	At the Cottages.			At the Offices.		
	£.	s.	d.	£.	s.	d.
Diggers' and bricklayers' works	75	13	1	19	13	4
Masons' works	4	7	3	1	4	0
Slaters' and plasterers' works	35	10	9	1	4	7
Carpenters' and joiners' works	62	9	5	4	16	10
Smiths' and ironfounders' works	10	4	10		..	
Plumbers', glaziers', and painters' works	12	12	7	2	9	2
Total . . . £.	200	17	11	29	7	11
If bricks are made by the proprietor, stone for walling procured upon the estate, or other local advantages are available, deduct from these amounts at least 10 per cent.	20	2	0	2	18	10
Total . . . . £.		15	11	26	9	1

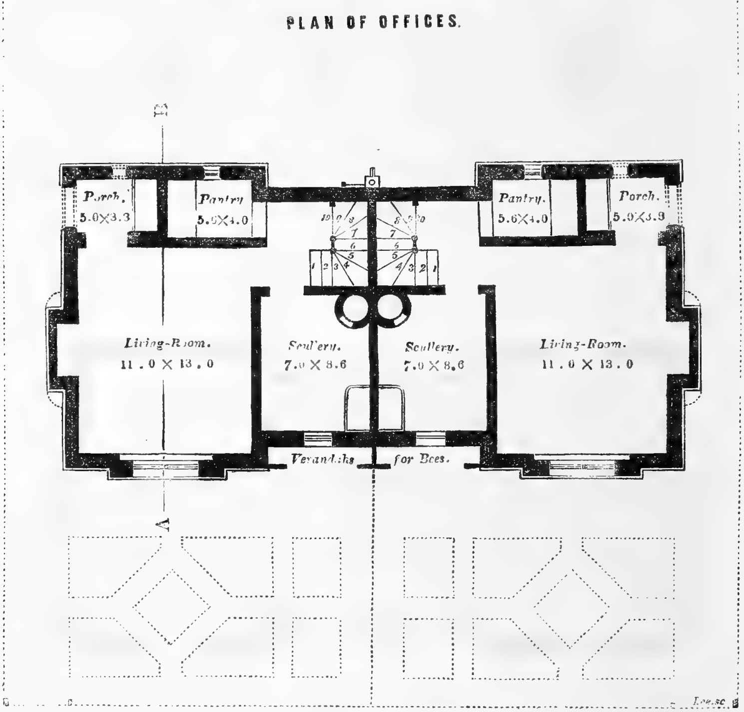
The Verandah is an ornamental appendage, and will cost 3*l.* 15*s.* for the two cottages.



13-INCH COTTAGE GRATE FOR 3-FEET 4 INCHES OPENING.

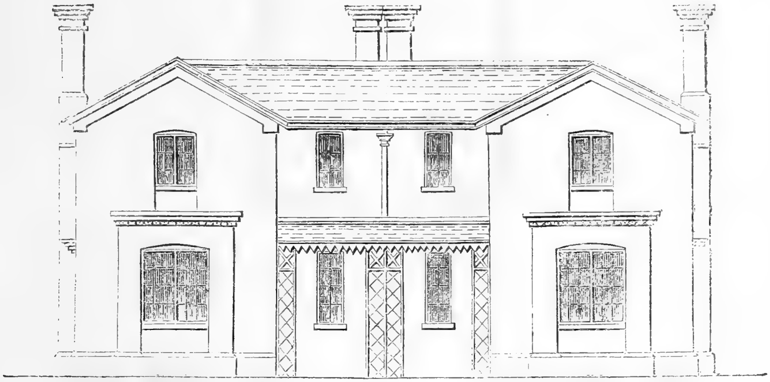


PLAN OF OFFICES.

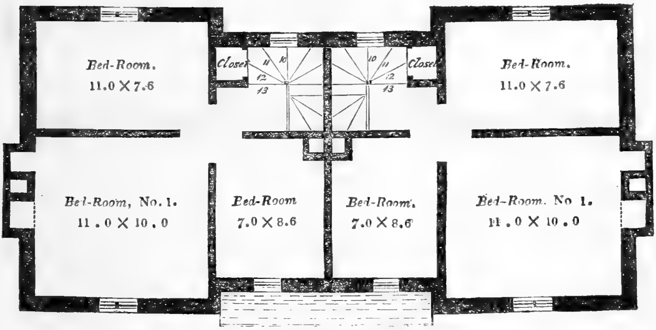


GROUND PLAN.

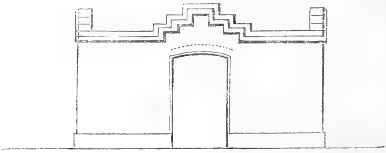
Road.



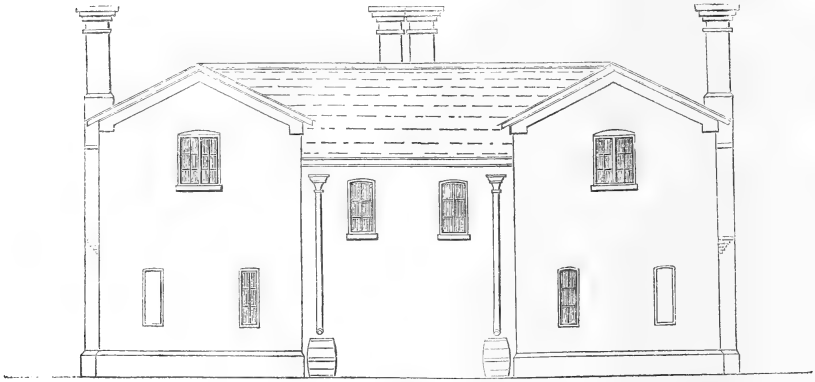
SOUTH ELEVATION.



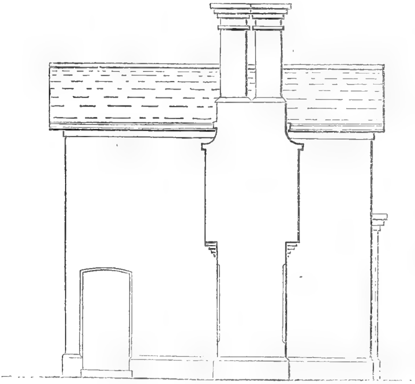
CHAMBER PLAN.



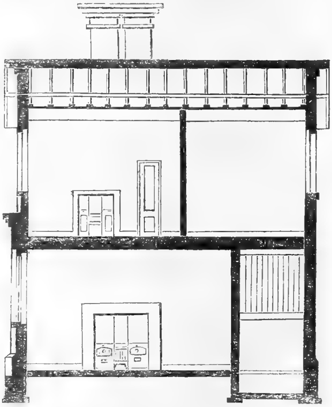
ELEVATION OF OFFICES.



NORTH ELEVATION.



WEST ELEVATION.



SECTION ON THE LINE A B.

XIII.—*On the Use of Rapecake as Food for Stock.* By Ph. Pusey, M.P.

Two kinds of oilcake, as is well known to farmers, are used in high cultivation—one, the refuse of flax-seed, linseed-cake, for the feeding of stock; the other, a less expensive article, the refuse of rape-seed, as a manure for wheat. Having been informed by a French farmer that it is the practice in French Flanders to mix rapecake with oilcake in the proportion of one to two for the nobler purpose, I tried the experiment last winter, when linseed-cake cost about 9*l.* and rapecake about 5*l.* per ton.

The cheaper cake, having a hot taste, was mixed with the other at first in the proportion of one-tenth, and the fatting tegs, half-breds chiefly, but a few of them Downs, ate the mixture with little reluctance. The admixture of rapecake was gradually increased until it reached the proportion of one to three, or one-fourth of the whole, when symptoms of mutiny showed themselves, and we did not think it expedient further to adulterate the rations, but continued at that proportion; and among more than 400 tegs so fatted no mishap occurred from the use of rapecake, though occasional symptoms of purging arose. The rapecake was tried with some fatting heifers,* but as they did not take to it readily, and were in an advanced state, I did not think it worth while to press the point with them, for fear of throwing them back in condition. In Flanders, however, horned cattle are fed partly with rapecake. The most decided success was with about 60 old Down ewes, which, having borne twin lambs, were kept apart as usual to receive better food. These being more sharply set than the fatting tegs, allowed my shepherd gradually to increase the proportion of rapecake until *no linseed-cake was given at all.* This of course is an important saving, if the cheaper cake be as nourishing as the dearer one. In that important respect my shepherd could observe no difference; but the question seemed to be fit for chemical analysis, and was referred by me to Mr. Way, whose answer was satisfactory, being as follows:—

"I have had an analysis made of the rapecake you sent me: it contains

Nitrogen	5·23 per cent.
Oil or fat	11·63 per cent.

In neither of these particulars does it much differ from linseed-cake, of which I have examined eleven specimens, containing on an average

Nitrogen	4·60 per cent.
Oil or fat	11·90 per cent.

The oil is in general about from 12 to 14 per cent."

---

* I propose, however, trying it next winter for cows kept in the yard upon mangold-wurzel and barley-straw, as was done successfully last year on Sir Robert Peel's farm at Drayton Manor. Unless the cake scoured the cows, it must, if given in moderation, improve, I should think, the quality of the milk.

As these two ingredients, nitrogen and oil, represent in Mr. Way's opinion the feeding properties of cake, science appears to confirm the experiment, and I cannot but hope that it may be useful to farmers, as justifying a saving of some considerable amount in preparing their sheep for market. I will only add, that though the use of rapecake as food has had no bad consequence with nearly 500 sheep of my own, I hope that any one who is disposed to give it a trial, will do so gradually and with caution, lest any unforeseen injury be the consequence.

Pusey, May 21, 1849.

XIV.—*A Lecture on the Anatomy and Physiology of the Maternal Organs of Reproduction in Animals, with the Principles of Practice applicable to Cases of Difficult and Preternatural Labour, more especially in the Cow and Ewe.* By JAMES BEART SIMONDS, Lecturer on Cattle Pathology of the Royal Veterinary College, London; Honorary Member of the Royal Agricultural Society, &c.

MY LORD DUKE AND GENTLEMEN,—On an occasion like the present, knowing that so many and important matters require your attention, I shall not presume to intrude unnecessarily upon your time by the introduction of remarks which are purely of a prefatory nature. It is, therefore, my intention to proceed forthwith to the consideration of the subject which has been selected for this lecture, namely, the general structure and function of the organs of reproduction in the cow and ewe, and the rules or principles which should guide us in cases of preternatural parturition. As the latter is that which chiefly interests you as men of practice, so it will receive from me the fullest description; but it is of equal importance that I should explain the construction of those parts in the female which are specially employed in the act of parturition. It fortunately happens that no argument is needed to show to either the scientific or practical breeder, or to those more immediately connected with the feeding and rearing of our native breeds of cattle, the necessity of such investigation. It is a matter which may be said to come home to all, being intimately identified with our agricultural, and therefore with our national, prosperity. As Englishmen we may well be proud of our improved cattle and sheep, which are at once the boast of Britain and the envy of the world. But we might ask, how frequently are the hopes of the breeder disappointed, and his endeavours to improve a race of cattle rendered fruitless, by the casualties attending upon their birth? In such a dilemma science stands waiting, and offers a ready hand to guide him through difficulties and overcome danger. Essential therefore to success is a knowledge of the principles to which we have alluded, and which will form the basis of this discourse.

It is not our intention to enter on the *vexed* question of the best means to improve the breed of any particular class of animals, nevertheless we may be allowed to make a few passing remarks on what is commonly designated "the theory and practice of breeding."

Breeding with a view to improvement may be said to be founded on an established law of nature, that *like produces like.* We should, however, always bear in mind that in animals there is a perpetual tendency to change, by which the development of their frame and strength of constitution are materially influenced, arising from a variety of causes, such as domestication, system of management, removal to a different climate, a continued habitation of the same district, partaking in general of the same diet, feeding on many kinds of provender, a liberal or niggardly allowance of food, especially when young, with protection from or exposure to the inclemencies of the weather, &c. But although these may be regarded as the chief causes in operation to produce the tendency to change, still among them we have the required means to promote the permanent improvement of a breed. Thus it will be seen that, in the language of Sir J. Sebright, "it is not always by putting the best male to the best female that the best produce will be obtained; for should they both have a tendency to the same *defect,* although in ever so slight a degree, it will in general preponderate so much in the produce as to render it of little value." *

In order to improve a particular race of animals, two plans are advocated by the two classes of practical breeders. One of these is commonly called "the crossing," the other "the in-and-in" system. The latter of these was strongly advocated by the late Mr. Bakewell, and his example had at least the effect of destroying the great prejudice which existed against breeding from animals having a close relationship to each other. The too rigid adoption of this plan is found, however, to produce degeneration, and therefore its advantages are limited: for animals of the same family, living in the same locality, and subjected to the same system of management, are predisposed to the same defects and diseases, and these become hereditary. Besides which, every improvement of a breed requires the application of the same means to maintain it which produced it, and the chief of these is *care in the selection* of both the male and female, so as to avoid the consequences of that predisposition to which we have alluded. As with defects so it is with improvements; these are transmitted from parent to

---

* "The Art of Improving the Breeds of Domestic Animals," by Sir John Saunders Sebright, Bart., M.P. London 1809.

offspring. Hence when *care in selection* is fully and efficiently carried out, deterioration from ordinary causes does not so rapidly occur. To assist in overcoming these causes, the taking of animals from different families and localities, or "crossing," is adopted. But even here care in selection is of equal importance.

We have spoken of hereditary predisposition to disease: this is exemplified by the fact that horses bred from "roarers" are so susceptible of this abnormal state of the respiratory organs, that "roaring" follows from causes which would be insufficient to produce it in other horses. And experience has shown that very many of the young horses sent from this county (Yorkshire) to London, being in this condition, early become diseased through the altered circumstances under which they are placed. That which is true with regard to horses applies equally to cattle, sheep, and all domestic animals. As with disease so it is also with colour; this not only becomes immediately hereditary, but passes back, as it were, through several generations; hence the necessity of looking to the *purity* of a breed. In illustration of this position I quote from Mr. Wilkinson's Letter to Sir J. Sebright, wherein we read that, "suppose a number of pure Devon cows to be crossed with a breed of perfectly white bulls, it is probable that some of the calves would be perfectly red, others white, and the greater part would partake of these colours jointly. If we were now to take the red heifers produced by this cross, and put them to a Devon bull, it would not be a matter of any great surprise if some of their progeny, though sprung from red parents, should be perfectly white, and still less that several should be mixed with this colour; though it would not, by any means, be so probable as in the former instance. And were we thus to proceed through several generations, this white colour would be less and less apparent in the breed, but would most probably occasionally show itself in some individual or other. If, on the other hand, we were to breed from pure Devons only, that is, from those that have been carefully bred for a great length of time, we should reasonably expect their offspring to be of the same colour with the parents themselves."[*]

It has often been remarked, that wild animals undergo but very slight changes either in form, size, or colour; the reason of this, in many tribes, is obvious. We may take the class to which deer belong as an example. At the season of rut, when the herds commingle, great contentions take place between the males, by which the larger number of females falls to the most vigorous and healthy males, and a strong progeny is the result. Besides which, many of the weaker animals not unfrequently are carried off by the cold and privations of winter, thus leaving parents of good

---

[*] "Remarks on the Improvement of Cattle, in a Letter to Sir J. S. Sebright," by J. Wilkinson. Nottingham, 1820.

constitutions, and able to support their young, during the earliest periods of their life. In these uncongenial seasons, the robust, however, do not suffer to an extent sufficient to produce permanent injury, as the range they take is extensive, and thus space makes up for the local deficiency of herbage, and exercise overbalances the sedative effects of cold. Many other reasons might be advanced were it necessary: these, however, are sufficient to show that here we have nature's plan of *selection*, which man but imitates in the *care* he bestows in pairing animals to breed together.

There are several singular circumstances connected with this division of our subject, and which may be here mentioned, although their causes cannot now be discussed. To speak of the existence of affection, or of favourable impressions in a female towards a particular male of another variety, but of the same species to which she belongs, being so strong as to influence the form and colour of her offspring, the immediate produce of a different male, appears to be very speculative, if not otherwise objectionable. Love of animals to man is however an attribute the possession of which will scarcely be denied to them. We know but little of the affection they have for each other, nor of its bounds or duration, and consequently it is difficult to say whether the facts we shall mention do in reality depend upon it or on the *one* sexual connexion with a favourite male exciting a peculiar development in the still immature ova of the female. The physiologist and the psychologist could each bring forward many well-grounded arguments in favour of his particular view. With these we have not now to do, and therefore we proceed to narrate the cases themselves. The first is as follows:—"The Earl of Morton, being desirous of obtaining a breed between the horse and the quagga, selected a young mare of seven-eighths Arabian blood, and a fine male of the latter species, and the produce was a female hybrid. The same mare had afterwards, first a filly and then a colt by a fine black Arabian horse. They both resembled the quagga in the dark line along the back, the stripes across the forehead, and the bars across the legs. In the filly the mane was short, stiff, and upright, like that of the quagga; in the colt it was long, but so stiff as to arch upwards, and hang clear of the sides of the neck. In other respects they were nearly pure Arabian, as might have been expected from fifteen-sixteenths of Arabian blood."* The second case is analogous, but it occurred in the pig:—"D. Giles, Esq., had a sow of the black and white kind, which was bred from by a boar of the wild breed of a deep chesnut colour: the pigs produced by this intercourse were duly mixed, the colour of the boar being in some very predominant.

---

* "Bell's British Quadrupeds," page 392.

The sow was afterwards bred from by two of Mr. Western's boars, and in both instances chesnut marks were prevalent in the litter. which in other instances had never presented any appearance of the kind." * The third we shall quote is thus given:—A cow, the property of Mr. Mustard of Angus, "chanced to come in season while pasturing in a field which was bounded by that of one of his neighbour's, out of which an *ox* jumped, and went with the cow until she was brought home to the bull. The ox was white, with black spots, and horned. Mr. Mustard had not a horned beast in his possession, nor one with any white on it. Nevertheless the produce of the following spring was a black and white calf with horns." †

We select one other case, and in another animal, namely, the dog:—"On one occasion when the late Dr. Hugh Smith was travelling in the country, accompanied by a favourite female setter, she became suddenly so enamoured of a mongrel that followed her, that to separate them, he was forced, or rather his anger irritated him, to shoot the mongrel. The image of this sudden favourite, however, still haunted the bitch, and for some weeks after she pined excessively, and obstinately refused intercourse with any other dog. At length she admitted the caresses of a well-bred setter; but when she whelped, the Doctor was mortified with the sight of a litter which he perceived bore evident marks (particularly in colour) of the favoured cur, and they were accordingly destroyed. The same also occurred in all her future puppings: invariably the breed was tainted by the lasting impression made by the mongrel." ‡ The latter two cases, and many similar ones which might be related, particularly in the dog, would seem to show that mental impressions received at the time of œstrum are of themselves sufficient to stamp the progeny. Be this as it may, each has a practical bearing, which he who looks to the preservation of the purity of a breed will not fail to profit by.

Before concluding this section of our address, it will be right to allude to the circumstance that accidental varieties, or *lusus naturæ*, may, by care in their selection, form the types of a future progeny. The solidungulous breed of swine, the two digits or toes being united and covered with a hoof similar to that of the horse, is thus accounted for, as is also the ancon or otter breed of sheep.

We proceed to speak of the general structure and functions of the organs of reproduction in the cow and ewe—these are the vagina, uterus, Fallopian tubes, and ovaries, with their several appendages. In an unimpregnated state the uterus is chiefly lodged within the pelvic cavity, but encroaches more or less within

---

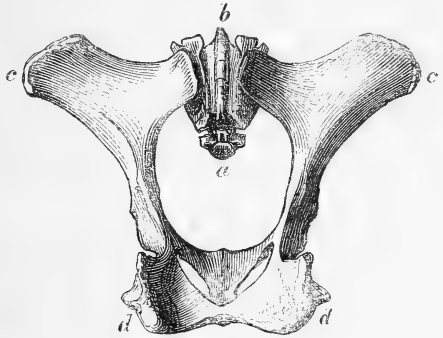
* "Philosophical Transactions," 1821.

† "Quarterly Journal of Agriculture," vol. i., Essays, p. 28.

‡ "Blain's Canine Pathology," 1832.

the abdomen when in the opposite condition. The cavity of the pelvis is formed by the bones constituting the hips and buttocks (see fig. 1), and it is important to bear in mind that its size will materially interfere both with the rapidity and safety of parturition. Many an animal is lost from too narrow a pelvis mechanically obstructing delivery. The practical breeder should therefore always remember, that external form is but a type of internal development, and consequently when the hips are narrow, the buttocks compressed together, and the spine drooping, the size of the pelvic cavity must be small, and parturition thereby rendered more dangerous. The annexed woodcut (fig. 1) shows the relative connexion that the bones of the pelvis have to each other, and the way in which they form the opening through which the fœtus passes in delivery.

Fig. 1.

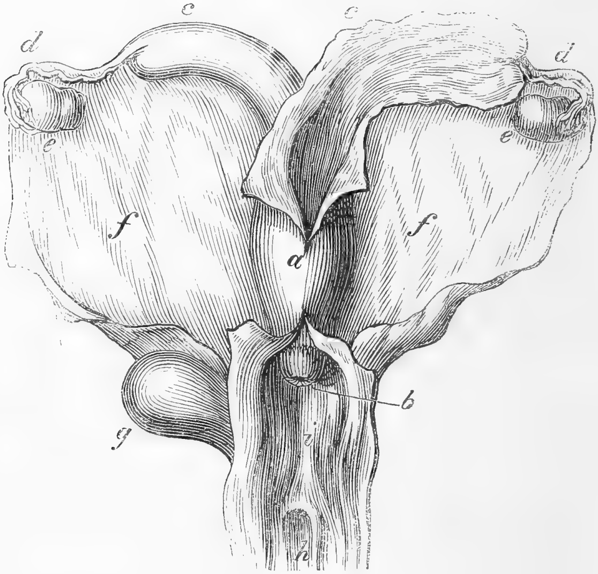


a.—The pelvic cavity.
b.—The sacrum, a continuation of the spine.
c, c.—The projections, called the hips.
d, d.—The bony prominences of the buttocks.

The vagina, *i* (fig. 2), extends from the external shape, the *labia pudendi*, to the mouth of the womb, *b;* it is placed at the lower part of the pelvis, and has the rectum above it, and receives inferiorily the opening of the urinary bladder, *h;* previous to parturition its walls become flaccid, and its inner surface is bedewed with a copious mucous secretion to favour the passage of the fœtus. In the act of coition the intromittent organ of the male is placed within the vagina, and is thus brought in contact with the mouth of the womb, by which means the fecundating fluid is conveyed into that organ.

The uterus, or womb, *a*, is held in its situation chiefly by the broad ligaments, *f f;* at its anterior part its coats are continuous with the vagina, and posteriorly it is divided into the two horns, *c c*, which have attached to their extremities the Fallopian tubes, *d d*, and connected with these are the ovaries, *e e*. During the period of gestation the os uteri (mouth of the womb) remains closed; but at the time of parturition it is widely dilated, thus forming a free and open passage from the vagina to the interior of the uterus. The coats of the uterus are three, and are united to each other by areolar tissue: the external or serous coat is smooth and continuous with the lining membrane of the abdomen; it gives support to the viscus, and by its reflections forms the two broad ligaments. The middle or muscular coat varies considerably in strength and thickness, referable to impregnation or non-impregnation; it is thin and comparatively weak in the latter case, and its fibres, which interlace each other in every direction, become greatly increased during gestation. On the muscular coat the expulsion of the fœtus from the uterus in delivery partly depends. The internal or mucous coat has a velvety appearance, and it secretes the menstrual fluid; but its principal use in the lower animals is to form a bond of connexion between the mother and her young ones, by which their vitality is preserved and their development effected. To this we shall hereafter more especially refer.

Fig. 2.



a.—The body of the uterus.
b.—The os uteri.
c, c.—The horns, one of which is laid open.
d, d.—The Fallopian tubes, with their fimbriated extremities.
e, e.—The ovaries.
f, f.—The broad ligaments.
g.—The urinary bladder.
h.—The opening of the bladder.
i.—The vagina cut open to show the passage leading to the bladder and os uteri.

We will now add a few remarks on the causes of œstrum, impregnation, and the development of the fœtus. The term œstrum is employed to designate that condition of the female which shows her fitness and desire for the male. Its early or late appearance is governed by a variety of external circumstances. It is associated with puberty, and passes off on the approach of old age. In some of our improved breeds of cattle, especially when well kept and tended, œstrum comes on very early in life, and in such instances the animal often conceives when she is little more than a year old. These early conceptions, however, too frequently prove injurious, by interfering with the development of the frame of the female, and also by deteriorating the quality of her offspring. Domestication, with its ordinary accompaniments, exerts a considerable stimulating influence on the generative system; thus some animals which in a state of nature produce but one litter a year, will, when domesticated, bring forth several: such are the dog and pig. The immediate cause of œstrum is the existence of fully matured ova within the ovaries of the female; and when these escape, without coition and consequent impregnation, we observe a temporary cessation of the desire until other ova are equally perfected. It follows, therefore, that impregnation can only be effected when the ova are in this condition. The time occupied in the development of the ova differs in different animals, hence the variation we witness in their return to the male. The ordinary symptoms of œstrum in the cow and other animals are too well known to render it necessary to repeat them; and it is sufficient to state that they denote a highly excited state of the system. Impregnation is produced by the fecundating fluid of the male acting on the matured ovum of the female, which action probably takes place in the ovarium. Physiologists are acquainted with many phenomena which illustrate this. The way in which the male or seminal fluid finds its course through the body and horns of the uterus, and thence through the Fallopian tube to the ovarium, is disputed. Its conveyance, however, is generally believed to be effected through the agency of moving filaments, called spermatozoa, with which it abounds. Hence it is all important that the Fallopian tubes should be pervious, or impregnation cannot take place. If their passage be obliterated, as we have often proved by the experiment of passing a ligature around them, the animal is as effectually rendered non-productive as if the whole parts had been taken away. The above facts explain how it is that, in the ordinary operation of spaying, the simple removal of the ovaries, leaving *in situ* the uterus with its horns and Fallopian tubes, destroys the desire as well as the power of conception, and when by accident or otherwise the operator leaves behind an ovarium, all other parts being cut away, the animal returns to the male, notwithstanding she is sterile.

The impregnated ovum when it bursts and escapes from its ova-sac is seized or entangled by the fimbriated edge of the Fallopian tube, and subsequently conducted into the uterus, where it excites that extraordinary action which leads to the formation of a new creature in every essential particular like its parent. Should the ovum not be caught by the fimbria, it falls into the cavity of the abdomen, but is not necessarily destroyed, as even here, although out of its proper matrix, it sets up an analogous action to that which otherwise would have been produced within the uterus. Thus we have explained the formation of those extra-uterine fœtuses, which are occasionally met with both in human and veterinary practice.

Without describing the earliest stages of the formation of the fœtus from the impregnated ovum, it will be sufficient to remark that in the descent of the ovum into the uterus it receives a coating of effused fibrin, which forms the membrane termed the corium, by which the fœtus is attached to the inner surface of the womb, and obtains from the mother the materials necessary for its vitality and growth. The outer surface of the corium (see *Plate*) is thickly studded in the cow and ewe with shaggy projections, *c*, named cotyledons, and these are fitted into corresponding concavities, *b*, in the membrane lining the womb, the *tunica decidua uteri*, thus forming the bond of connexion we have spoken of. The tufts of the corium contain the ramification of the fœtal vessels, and the concavities of the *tunica decidua uteri* the enlarged and elongated branches of the uterine arteries of the mother: thus by the two sets of vessels lying in contact, the blood of the fœtus is purified and reinvigorated, as the maternal blood is more highly oxygenated than that of the fœtus. The change which is effected is a chemical one, and analogous to that taking place in the lungs of an animal after birth; the cotyledons, therefore, may so far be regarded as the fœtal lungs. Besides this important office performed by them, the vessels of the fœtus are here surrounded by a thick layer of cells which absorb nutrient matter from the mother and transmit it to the blood of the fœtus. Hence the cotyledons may also be compared to the stomach, or rather to the digestive and assimilative organs of a perfect animal. Thus it will be seen that although there is no direct communication between the vessels of the mother and those of the fœtus, yet every requisite for its life and growth is provided for.

Besides the corium, there are two other membranes to be noticed as belonging to the fœtus, the amnion, *g*, and the allantoid, *e*. The amnion immediately surrounds the body of the fœtus, and secretes a fluid, the *liquor amnii*, in which it floats, and by which it is protected from those injuries which might otherwise destroy its life: it being a property of fluids to diffuse and modify the force of a blow. The liquor amnii, with its investing membrane, is also made to serve a no less important office, that of being protruded into the mouth of the womb at the commencement of parturition, thus acting as a hydrostatic dilator.

The allantoid membrane is situated between the amnion and corium, where it forms a sac to receive the urinary secretion of the fœtus: it is of large size in the lower animals, and its dimensions increase with the growth of the fœtus, a phenomenon which is not observed in the human subject. The allantoid sac has a direct communication with the true urinary bladder by means of the urachus (see Plate, *f*). The umbilical cord, *h*, is composed of this tube, the urachus, and the arteries, *i*, which convey the impure blood out of the body of the fœtus to the cotyledons, and the veins, *j*, which return it after having been re-oxygenated in the manner previously alluded to. It will be evident from the foregoing remarks, that a due provision is made for an equal distribution of this pure blood through the body of the fœtus, so that every part of the frame may be built up at the same time; consequently we meet with vessels in the fœtus that are not needed after birth. To enter more fully into this interesting and instructive subject, would be to encroach on the practical part of our lecture, and therefore I proceed to speak of the symptoms of pregnancy and the period of utero-gestation.

Explanation of the Plate opposite.

a.—The interior of the uterus, studded with, *b*, the maternal portions of the cotyledons.
c.—The outer surface of the corium, with the tufts of the fœtal vessels, some of which are seen in union with the maternal portions of the cotyledons.
d.—The inner surface of the corium.
e.—The allantoid membrane, which forms a receptacle for the urinary secretion of the fœtus.
f.—The urachus, or passage through which the urine is conveyed to the allantoid sac.
g.—The amnion, the membrane which envelopes the fœtus, and secretes the fluid in which it floats.
h.—The umbilical cord, showing, *i*, the arteries conveying the impure blood to the cotyledons, and, *j*, the veins returning it after its purification.

The first and most striking indication of impregnation is the cessation of œstrum, the animal not returning to the male at the usual period, or refusing his overtures when introduced to him. With this is associated a general quietude of the system and a tendency to accumulate flesh, and in some animals, as the mare, a sluggishness while at work. Shortly afterwards the abdomen is found to increase in size, the loins to droop, and the muscles of the croup to be less prominent. The *labia pudendi* are swollen and flaccid, a blush of redness pervades these parts, extending into the vagina, from which an augmented quantity of mucus is discharged. The abdomen gradually gets larger and larger, and has a peculiar round appearance at its lower portion, with a falling in immediately beneath the bones of the loins. As the period of labour approaches, the mammary gland enlarges, the secretion of colostrum takes place within its follicles, and the teats are hot and full. When delivery is about to be effected, the animal becomes restless, often lies down, strains, rises again, changes her position, looks to her flanks, and carries the tail higher than natural, &c.

As I shall have again to allude to these indications, I pass on to remark on the means taken to satisfy ourselves that a fœtus does exist within the uterus. During the earliest periods of gestation the question of pregnancy is a most difficult one to decide, but subsequently that which was ambiguous becomes clear, and we are then enabled to make a correct diagnosis. As the fœtus is early located within the womb, so we shall find that, in such animals as will admit of the hand being passed up the rectum, we can detect its presence in the form of a small, roundish, and slightly moveable body situated below and without the intestine. The hand being quietly kept in this situation, and pressed upon the enlargement, will occasionally recognise voluntary movements in the living embryo. Some persons prefer to introduce the hand into the vagina, and carry it towards the os uteri so as to ascertain its condition; for, as I have elsewhere observed, the mouth of the womb is closely shut during gestation, and we also find at this time that it contains a layer of thick albuminous matter. There are serious objections to this latter proceeding, for when the manipulations are most carefully performed abortion will not unfrequently result. Percussion over the uterine region is also of great assistance; and auscultation has its advocates, who inform us that the ear placed in contact with the abdomen of an impregnated animal, and moved gently from spot to spot, will often detect the sound of the fœtal heart. We confess, however, that we have not succeeded to our satisfaction, although we have made very many investigations of this kind. With reference to percussion, all are practically acquainted with the manner in which this is adopted, and the side of the cow, viz. the right, that is selected. The inclination of the impregnated uterus to the right side depends upon the rumen being situated in the left division of the abdomen. In the still more advanced periods of gestation, fœtal movements can be seen while standing by the side of an animal; and as these are often found to be both stronger and quicker in the mare after drinking a full quantity of cold water, grooms and stablemen have frequent recourse to this plan; to which, however, we object, as spasms of the intestines and death have occasionally been produced by it.

The period of utero-gestation, or length of time that the fœtus is detained in the uterus, depends upon several causes, and differs in nearly every variety of animal unless belonging to the same tribe or family. The average period that the mare carries her young may be stated as being near to *forty-eight weeks*, the cow *forty*, the ewe *twenty-two*, the bitch *nine*, and the sow *sixteen weeks.* It certainly is a remarkable fact, and one which shows the mighty power of the allwise Creator, that, in animals placed so high in the scale of organised beings as the canine race, full and perfect development of their young should be effected in the short space of sixty-three days. If, however, we descend the scale, we shall find that this is comparatively a long period to be occupied in the perfecting of the offspring of the lower animals.

The late and much lamented Earl Spencer has recorded in the pages of your Journal * his observations on the duration of gestation in no less than 764 cows; and we are much gratified in being able to say that he has thereby rendered most efficient aid to science, as well as considerable service to the practical breeders of cattle. I refer to the table accompanying the paper for full details, but I shall nevertheless make an extract or two in consequence of the important bearing these statements have on this part of our subject:—" From the inspection of this table," his Lordship says, " it will be seen that the shortest period of gestation, when a live calf was produced, was 220 days. Any calf produced at an earlier period than 260 days must be considered decidedly premature, and any period of gestation exceeding 300 days must also be considered irregular, but in this latter case the health of the produce is not affected. It will also be seen that 314 cows calved before the 284th day, and 310 calved after the 285th; so that the probable period of gestation ought to be considered 284 or 285 days, and not 270, as stated in the book upon Cattle, published under the superintendence of the Society for the Diffusion of Useful Knowledge."

The facts here mentioned with reference to the great differences in the time of gestation cannot, even in the present advanced state of science, be satisfactorily accounted for. Dr. Carpenter, writing on the same subject, remarks that " the average length of time which elapses between conception and parturition in the human female appears to be 280 days or 40 weeks. There can be little doubt, however, that gestation may be occasionally prolonged for one, two, or even three weeks beyond that period; such prolongation not being at all unfrequent among the lower animals, and numerous well authenticated instances of it, in the human female, being on record. Upon what circumstances this departure from the usual rule is dependent has not yet been ascertained; but it is a remarkable circumstance, ascertained by the observations of cattle breeders, that the *male* has an influence upon the length of gestation—a large proportion of

---

* Vol. i., p. 165, *et seq.*

cows in calf to certain bulls exceeding the usual period, and a small proportion falling short of it. Hence we must attribute the prolongation of the period to some peculiarity in the embryo, derived from its male parent." * Alluding to the opinion which is also entertained with respect to the sex of the fœtus influencing the time of gestation, Earl Spencer observes, " there is a prevalent belief among farming men, and I believe farmers, that, when the time of gestation of a cow is longer than usual, the produce is generally a male calf. I must confess that I did not believe this to be the case, but this table shows that there is some foundation for the opinion. In order fairly to try this, the cows who calved before the 260th day, and those who calved after the 300th, ought to be omitted as being anomalous cases, as well as the cases in which twins were produced; and it will then appear that, from the cows whose period of gestation did not exceed 286 days, the number of cow-calves produced was 233, and the number of bull-calves 234; while from those whose period exceeded 286 days, the number of cow-calves was only 90, while the number of bull-calves was 152." This places the matter in so clear a light that it is unnecessary to add another word, and therefore I shall pass on to the last division of this lecture, namely, natural and preternatural parturition.

Labour, although perfectly natural, may occupy some time, or be rapidly effected; we observe a considerable difference in this respect among the different animals which man by domestication has rendered subservient to his use. Delivery under ordinary circumstances is quick in the mare, the birth of the foal rarely occupying more than a few minutes; in the cow half an hour may be regarded as about the average time after labour-pains show themselves; while in the ewe it not unfrequently happens that several hours will be spent in labour. I will here advert to a table in which I have attempted a classification of labours, showing the several varieties met with in practice.

CLASSIFICATION OF PARTURITION.

DIVISION.	VARIETY.
Natural	Quick. Lingering. Twin.
Preternatural	Lusus Naturæ. Every kind of Malpresentation.
Premature	do. do.
Protracted	Mechanical Impediments. Imperfect Throes.
Impractical	Maternal Defects.
Instrumental	Destructive, or not, of the Fœtus.
Complicated	Uterine Dropsy, Hæmorrhage, Rupture. Inverted Vagina, Bladder, Rectum. Ruptured do. do. do. Scirrhous Os Uteri, Lacerated Vulva. &c. &c. &c.

---

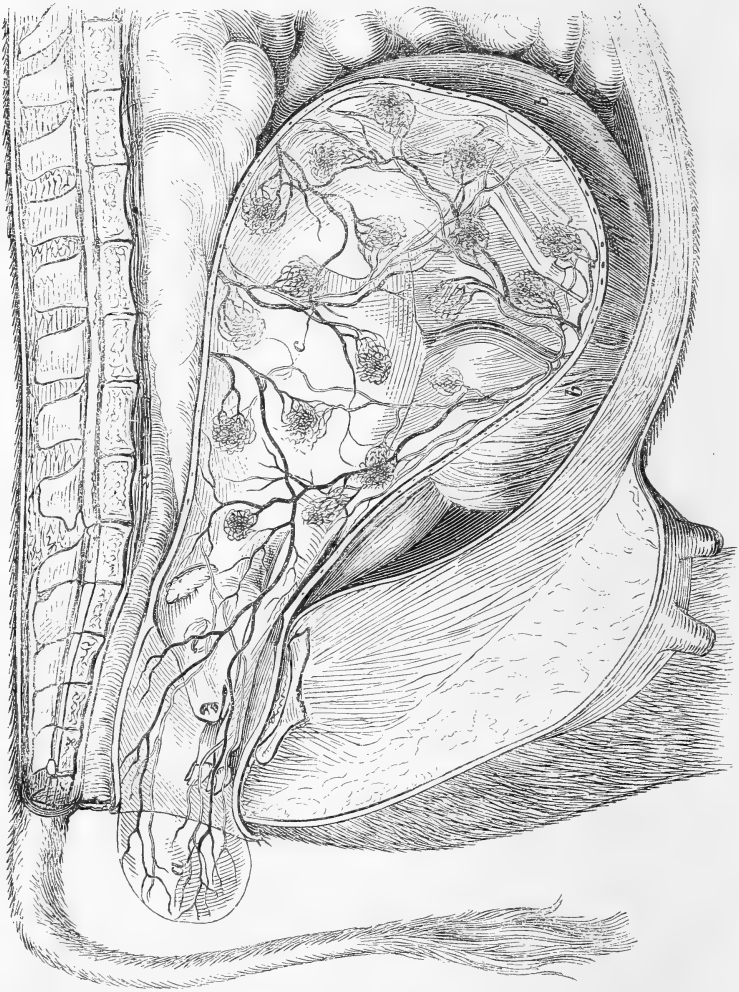
* Carpenter's "Manual of Physiology," p. 478.

Before describing *preternatural labour* arising from false presentations, I must speak of *natural* delivery and the way in which it is accomplished. The symptoms denoting the approach of parturition have been before described, namely restlessness, frequent change of position, lying down, quick rising, straining, &c.; these all indicate an excited state of the system accompanied with pain; this pain is not, however, of the ordinary character, but early becomes propulsive or bearing down, and also intermittent. It is important to distinguish between *straining* and the *true propulsive pains* of parturition; the former not unfrequently depends on the dilatation of the os uteri, and this, in many cases, precedes labour for some days. The dilatation of the mouth of the womb is often associated with great pain, and this is apparently proportionate to the freedom with which it expands. Proprietors of stock should not be in too great a hurry with their animals at the time of parturition, although they may express much uneasiness by continued *straining*. I have known many cases where valuable animals have been lost in consequence of impatience on the part of the owner in seeking too soon to give assistance. I have also frequently seen cases where the symptoms of approaching parturition have disappeared, and not returned for two or three days. A careful examination *per vaginam* may be made under these circumstances, and should the mouth of the womb be found only partially dilated, the case must be left to nature's efforts, when all will generally end well. I should state, however, that in *extreme* cases of this description an ounce dose of tinct. opii administered to a cow, and followed by an ordinary aperient, will be productive of much benefit.

The act of parturition, by which the fœtus is expelled from the uterus, is in part effected by the contractility of the muscular coat of the womb, and in part by the energetic action of the abdominal muscles. The cause of this contraction taking place at the expiration of a given time cannot be satisfactorily explained: it does not arise from the full development of the fœtus, nor its capability of living, comparatively, independent of its parent; if so, neither abortion nor premature labour would occur. Nor can the length of gestation be said to depend on the mere life of the fœtus, for then a dead fœtus would be cast off immediately, no matter what might be the stage of gestation; whereas daily instances are met with where a dead fœtus is retained the full time.

The mouth of the womb being freely dilated, and everything prepared for the birth of the young, the simultaneous and repeated contractions of the uterus and abdominal muscles propel the fœtus, covered by its membranes, first towards and next into the vagina. This advance is assisted by its position, and also by the pushing forwards of the liquor amnii. This fluid, contained within its proper membrane, first appears at the "shape;" and is commonly designated "the water bladder;" as soon as it bursts, the propulsive action of the uterus is brought to bear immediately on the body of the fœtus, by which it is ultimately expelled. In fig. 3 we have a view of the calf placed in the natural position and covered by the amnion, which, with its contained fluid, is protruding from the shape: the sketch will materially assist the description I have given.

Fig.. 3.



a.—The water bladder. *b, b.*—The uterus. *c.*—The fœtus enclosed within the Amnion.

With the birth of the young the mother experiences an immediate relief, but labour is not considered to be completed until the membranes have also been cast off. This is effected by a more gradual and far less painful action of the uterus, which first detaches the cotyledons from their numerous connexions, and then ejects the membranes by an augmentation of the propulsive power. After this the womb contracts with some force upon itself, and thus effectually compresses the mouths of the uterine vessels and stays the escape of blood.

It is not always that delivery is accomplished with the facility I have described, although the presentation is perfectly natural: delay may arise from a disproportion between the size of the fœtus and its dam, when force will be necessary to assist the expulsive throes. This assistance ought only to be rendered during the continuance of each *alternate* pain: by a steady adherence to this rule considerable resistance may be overcome, and the life of both the mother and her young preserved. We can call to mind one case in particular, where we succeeded to our perfect satisfaction in removing from a small Suffolk cow a calf, which weighed, when taken away, no less than 8 stone; (14 lbs. to the stone.) Upwards of two hours were occupied in the act; nevertheless we had the gratification of being instrumental in saving both the parent and her offspring.

Protracted labour in a natural presentation may result from congenital disease of the fœtus; that which is most commonly met with is dropsy of the abdomen, and this is depicted in the annexed sketch. Under these circumstances no advance can be made by the application of a proper amount of force, and the life of the fœtus should at once be sacrificed. To effect the necessary reduction in the size of the body by giving an exit to the fluid, a trocar of sufficient length should be thrust through the chest into the abdomen (as represented in the sketch), and the stilet withdrawn, when the pressure which is brought to bear on the fœtus, by the traction employed, together with the labour-pains of the mother, will be sufficient to forcibly drive the fluid through the sheath of the instrument, thus reducing the enlarged abdomen and facilitating delivery. Several years ago I was called to a mare in labour, where the obstruction to its progress depended on the accumulation of a large quantity of urine within the bladder of the fœtus, from a congenital closure of the urachus; the case cost me a great deal of labour and anxiety; the mare, however, did well; and I make mention of the circumstance for the purpose of stating that I was led to the subsequent employment of this instrument from the difficulty I then experienced. The particulars of the case are given at length in the 'Transactions of the Veterinary Medical Association for 1841-2.'

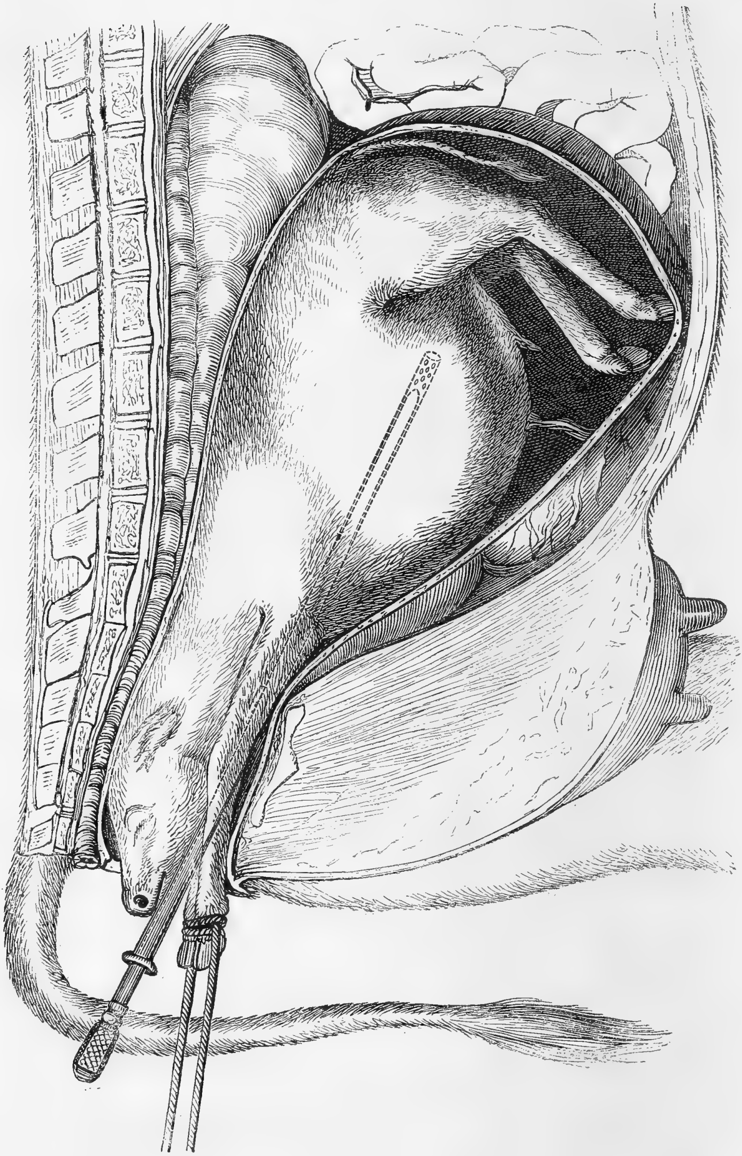


Fig. 4.

Among other causes of LINGERING LABOUR from congenital disease, and where the presentation is natural, is an accumulation of fluid within the cranial cavity, designated *water on the brain.* In such instances the body of the fœtus is unusually small, so that we have little to apprehend if we can succeed in reducing the size of the head. Having satisfied ourselves by an examination of the real condition of the parts, let the fore-legs be returned into the body of the uterus (*represented in fig.* 5), thus making more room in the vaginal passage for our further manipulations. Then place

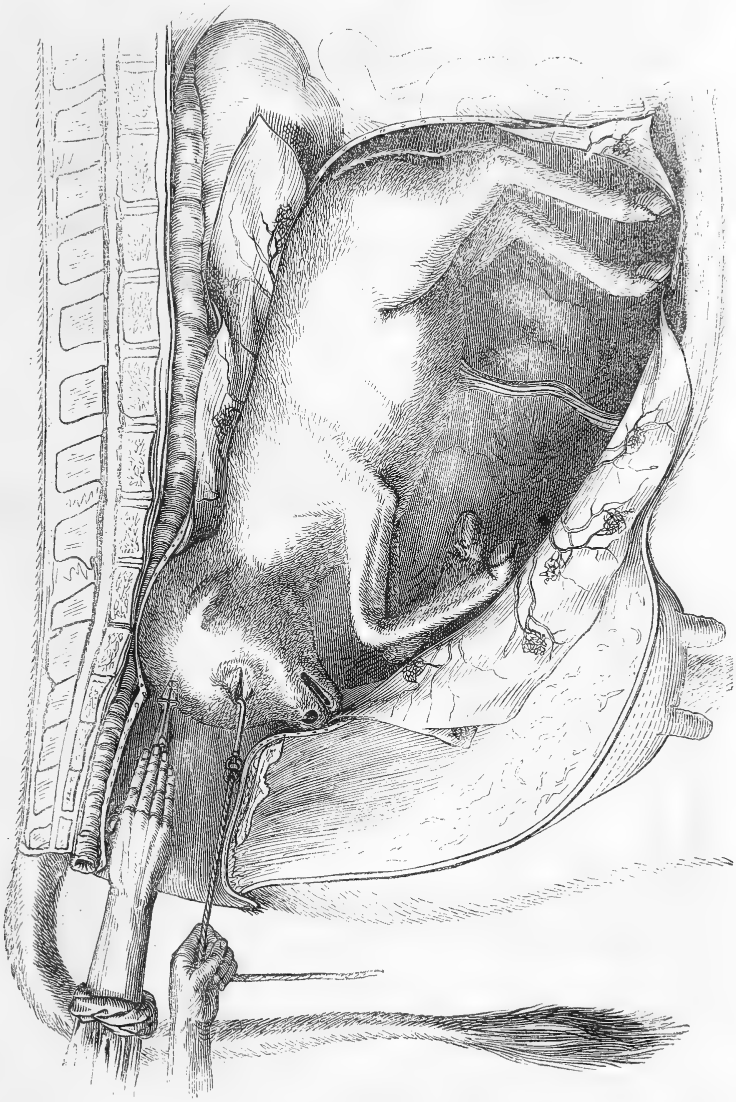


Fig. 5.

a hook attached to the end of a cord within the orbit, draw firmly at this with the left hand, so as to fix the head against the brim of the pelvis below, and the sacrum above. Introduce with the right hand an instrument called a perforator, thrust its point through the bones of the head, and split them asunder by compressing the handles of the instrument; an exit will thus be given to the fluid, and the bones will consequently now yield sufficiently to allow the fœtus to pass through the pelvic cavity. Prior to attempting delivery it is, however, necessary to re-adjust the legs by bringing one after the other into the vagina, when moderate traction alone will be needed to remove the fœtus; the force being applied in this, as in every other case, only during the maternal efforts to unburden the uterus.

Among the varieties of natural delivery we may name TWIN-LABOUR, although it rarely happens that both fœtuses are presented with the head and fore-legs advancing; one being thus placed, and the other in the reverse position. It is, however, in but few instances that the veterinary accoucheur is required when parturition is delayed, simply in consequence of twins: the young are generally of small size, and the one which lies in the natural position is first expelled, thus bringing the parts into a fit condition to favour the birth of the other. And here I would remark that neither the veterinary practitioner nor the farmer should ever leave a case of parturition in which his services had been required, without a manual exploration of the uterus to satisfy himself that another fœtus was not present.

I pass on to consider some of the principal forms of PRETERNATURAL PARTURITION; and the first to which I shall allude is the one depicted in fig. 6. It will here be observed that the two fore-legs have passed through the mouth of the uterus into the vaginal passage, while the head is turned back and lies in contact with the side of the young animal. This presentation is of common occurrence, and may be regarded as a mere alteration of the natural position, arising from the circumstance that, when the head reached the pelvis, instead of its passing onwards in a straight direction, it became turned a little aside, and the repeated throes of the mother acting on the hinder part of the body of the fœtus, forced it into the position here represented. The difficulty of adjusting the fœtus, and effecting delivery, will be proportionate to the distance the head is placed backwards. In some cases it will be found within our grasp, while in others we can only succeed, after repeated efforts have been made to reach the ear or the orbit. Under either circumstance we are first to secure the fore-legs, by passing around each, directly below the fetlocks, a cord having a running noose; they are then to be returned into the body of the uterus; after which pressure is to be made upon the

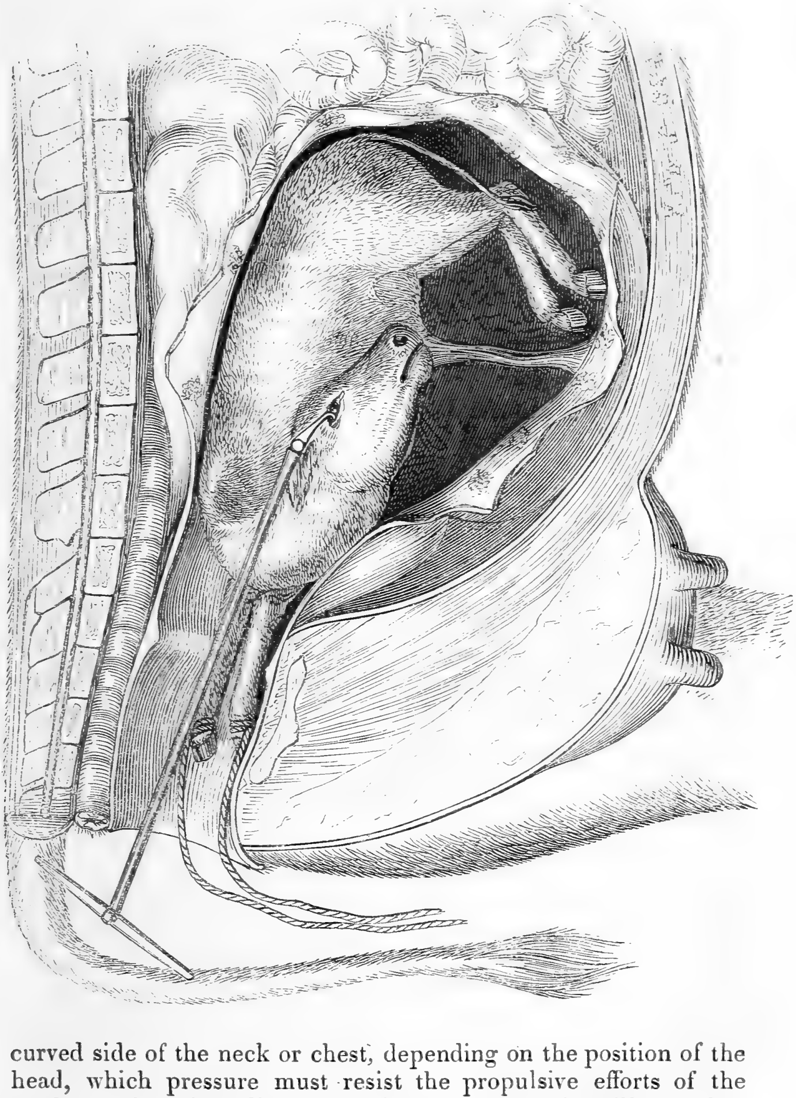
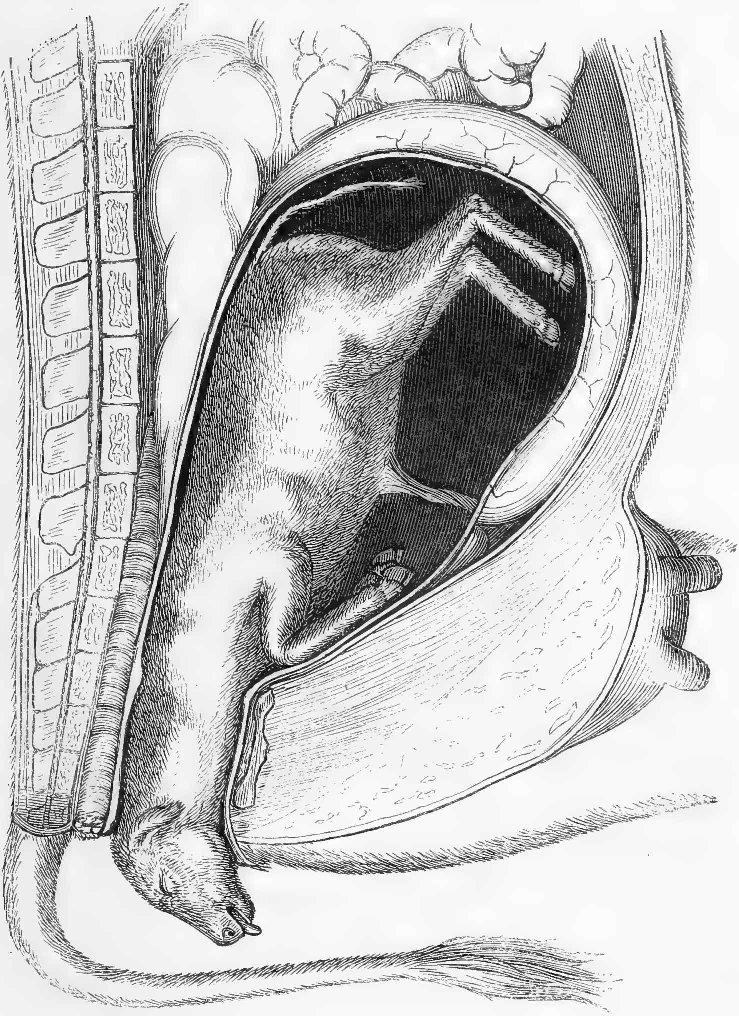


Fig 6.

curved side of the neck or chest, depending on the position of the head, which pressure must resist the propulsive efforts of the mother, when it will be found that the neck will be thus straightened and the head consequently brought nearer to the pelvic opening. We should remark, that in this presentation the fœtus is often found dead, and therefore we may venture to adopt those means which otherwise we should not have recourse to. In extreme cases, however, of this description, the preservation of the life of the mother is of the first consideration, and we must not hesitate to use instruments to facilitate our manipulations. A hook attached by a hinge-joint to a steel rod, and which has at the other end a cross-handle, removable at pleasure, is the most useful instrument which can be employed. The operator, taking the hook in his hand and carrying it towards the orbit, directs his assistant to advance or draw it backwards, as he may find it necessary, so as to aid his efforts to place it within the orbit. After having adjusted the head, the legs by means of the cords are to be brought up, and delivery accomplished in the usual manner.

The *second form* of false presentation that I shall describe is shown in the annexed sketch, fig. 7. It will here be seen that the head of the calf is protruding from the labia; in other words it is born, while the fore-legs and the rest of the body of the animal still occupy the vagina and uterus. The first remark to make is, that at the commencement of labour this was a presentation of the head within the vaginal passage, unaccompanied with the simultaneous advance of the legs, a condition of things of not unfrequent occurrence. Occasionally it will happen in this presentation, when the pelvis is large and the parturient pains very strong, that the head will be forced out; but far more frequently, its being born depends on the misapplied efforts of those who are called to give assistance to the cow. Farmers and others are too apt to imagine, when an examination proves the head of the fœtus to be located in the vagina, that by applying force and bringing it through, delivery will be effected; but it should be always remembered, that in mares and cows, and even in ewes, unless the lamb is very small and the pelvis of the ewe of full dimensions, it is impossible for this to be done. In a head presentation the operator should first place a cord, with a running-loop, on the lower jaw of the fœtus, next exercise force sufficient to return it into the uterus; afterwards adjust the legs, then bring up the head by drawing at the cord on the jaw and proceed to deliver. Should he be called to a case like the one figured, no attempts to return the head, or to draw away the fœtus, as I have before stated, ought to be made, as these will be altogether futile. The fœtus must at once be sacrificed that the life of the mother may be saved. Let an incision be made through the skin from the pole to the muzzle, and another from the gullet to the end of the lower lip; dissect the skin on either side from off the head so as to unite the upper and lower cuts, and then detach the skull from the trunk at the occipital joint. Having done this, attach a cord to the incised skin, and put back the neck into the womb; feel for, and place in, their proper position the fore-legs, then bring up the neck and deliver.

Fig. 7.



The *third kind* I shall mention is represented in fig. 8. In this instance one of the fore-feet protrudes through the os uteri, while the other foot and the head are still in the body of the womb—the latter being curved downwards and pressing on the brim of the pelvis. We have here an occipital and foot presentation, but which is not very difficult to overcome unless the labour-pains are very powerful. The first step to be taken is to secure the fore-foot in the manner described in the preceding cases, and the next to fasten a hook to one of the orbits. The hand is then to be re-introduced and carried towards the chest, following

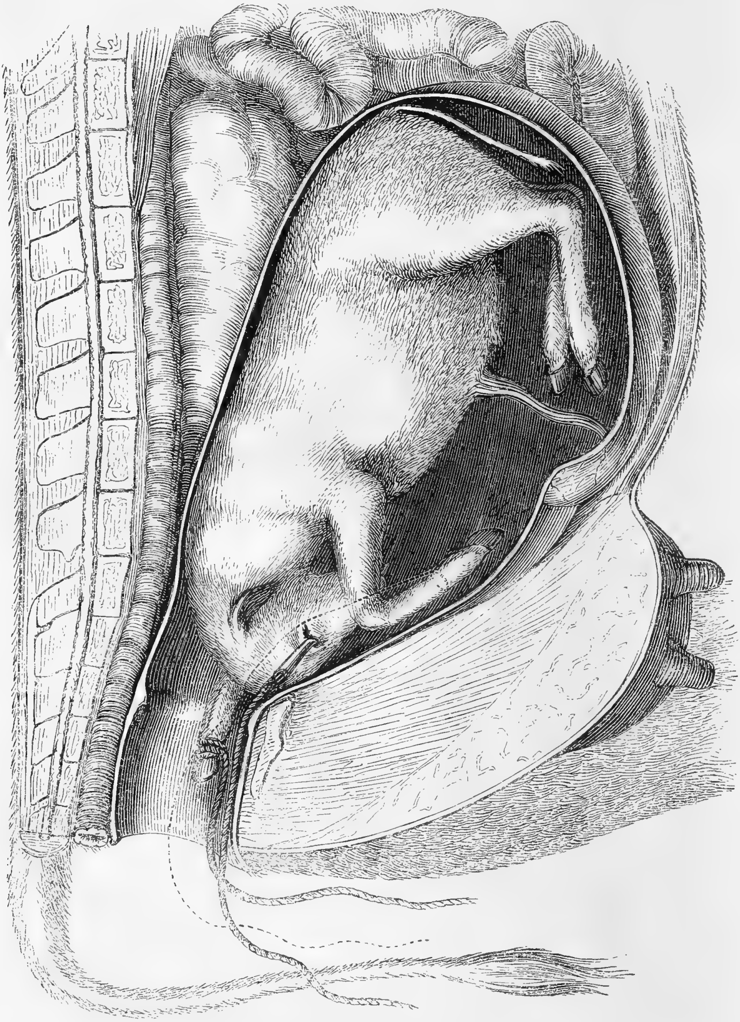


Fig. 8.

the direction of the protruding limb, and sufficient force employed to drive the fœtus backwards; this being accomplished, the hand is to be shifted to the upper part of the neck immediately behind the occiput, when moderate pressure being here made it will be effective in straightening the head and neck. When the operator has thus far succeeded, his assistant is to draw the cord attached to the head *moderately* tight to prevent it again bending downwards. Another cord is now to be carried in and made fast to the other leg, as shown by the dotted line in the sketch. The legs are then to be alternately brought forwards, and by simultaneously drawing at them and the head the fœtus will be extracted.

The *fourth variety* I select for explanation is shown in fig. 9.

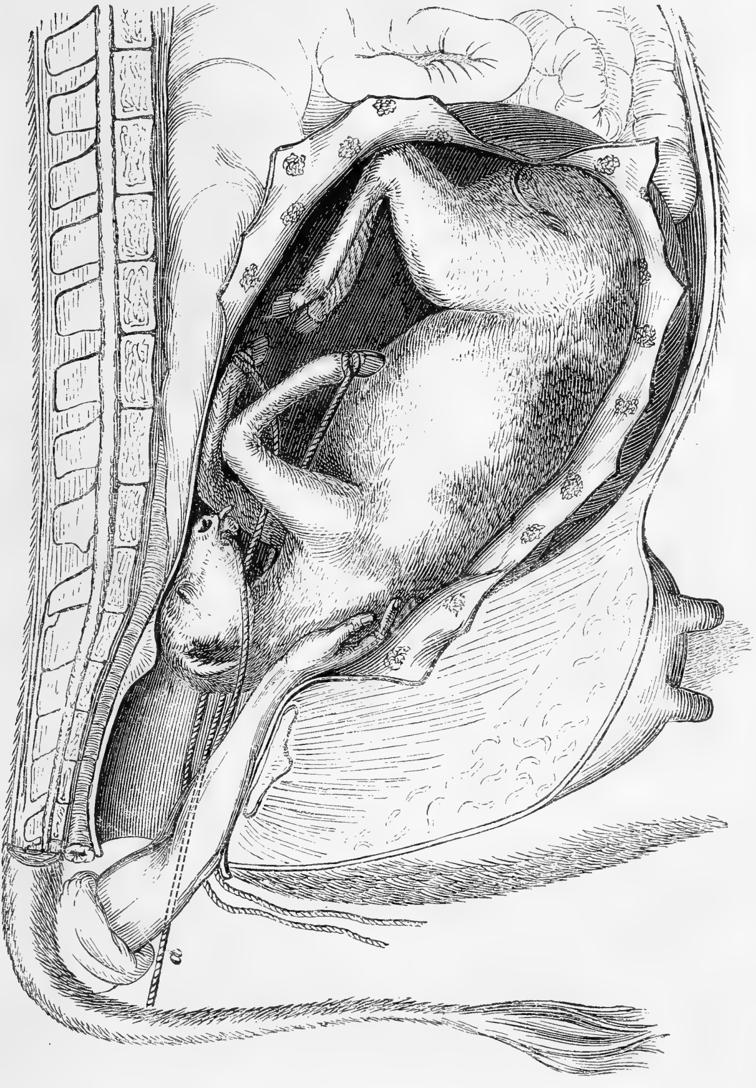


Fig. 9.

In this instance the calf is lying on its back in the womb, with the legs turned towards the spinal column of the cow. Labour here is usually of long duration, and various expedients are adopted by practitioners to adjust the fœtus prior to the employment of traction to remove it: but in most cases I have proceeded as follows:—first a cord has been placed on the lower jaw to secure the head so that at will it might be brought forward. Next, similar cords have been fastened on each fore-leg; the one attached to the leg represented in the fore-ground running on the outer side of the other limb, marked *a* in the sketch. An assistant has then been directed to draw *tightly* at this so as to facilitate our endeavours to turn the fœtus on its side, by placing the hand near the withers, as represented in the sketch. This being effected, the legs are brought into the vagina, and then the head: these additional manipulations will cause the fœtus to turn, as it were, upon itself, when it may be safely extracted.

One of the most difficult forms to deal with, and which invariably costs the practitioner considerable labour and anxiety, is that represented in fig. 10. Here we observe that the fœtus is lying with its head towards the chest of the cow, having the hinder parts pressed against the brim of the pelvis, and the hind legs placed under the body, so that on introducing the hand we can only feel the breech. We have here to reverse the position of the hind-legs and bring them into the vaginal passage, as delineated in fig. 11, or delivery will be impossible. The great difficulty in doing this arises from the little command we have over the parts from our inability to grasp the hind legs: consequently many years since I was led to construct a simple instrument to enable the practitioner to surmount this difficulty. The instrument, which is sketched in fig. 10, consists of a curved piece of steel having an aperture at one end, to which a small cord is attached, at the other a female screw is placed, which admits of its junction to a whalebone staff, and between the two another opening exists, into which is inserted a stronger cord.

Taking the staff with the two cords in his hand, the operator is to pass the instrument between the thighs of the calf, and push it in front of the stifle-joint, and then with a turn of the wrist to direct the small cord outwards. An assistant holding the instrument, the hand of the accoucheur is now to be introduced and directed to the front part of the stifle-joint, when the cord can be readily grasped and brought out; thus the limb will be embraced between the two cords: the whalebone staff is then to be detached, and the smaller cord to be run through a noose at the free end of the larger one, when, by drawing the smaller cord, the curved part of the instrument will travel round the limb, bringing with it the larger cord, and thus a looped ligature will be placed upon

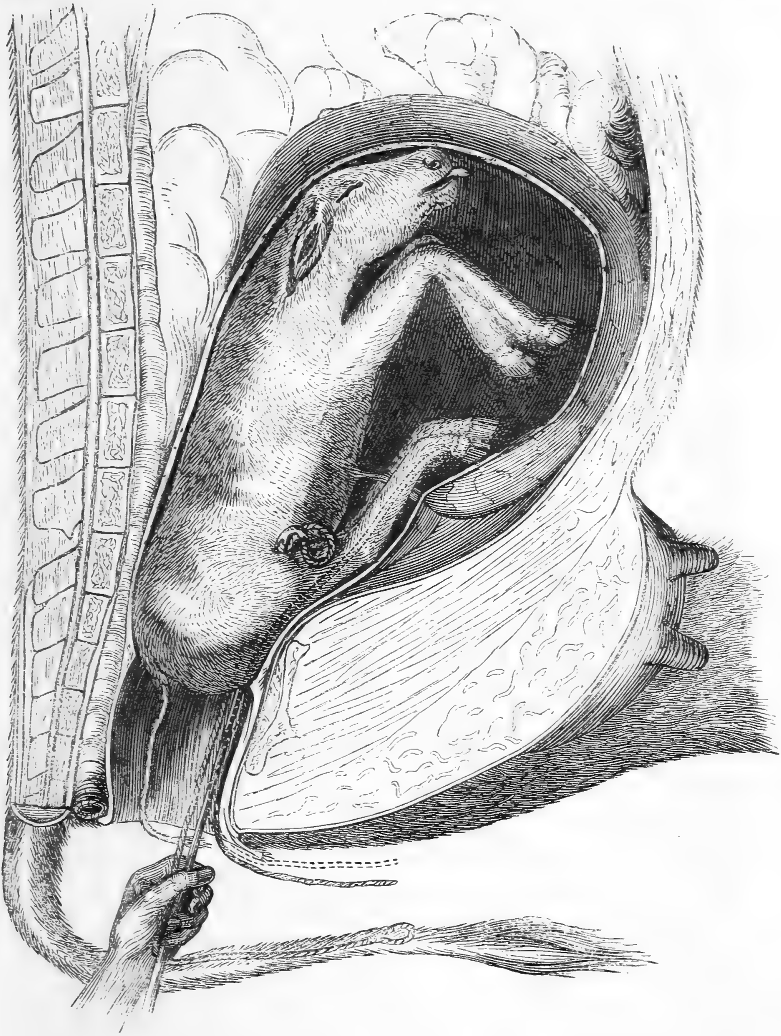


Fig. 10.

the leg above the hock. The like proceeding is to be adopted with the other leg. The operator is next to push the body of the fœtus forwards by either placing his hand against the breech, or employing for the purpose an instrument similar to an ordinary crutch: by these efforts he will succeed in flexing the hock-joints and be enabled to pass the loops downwards to the fetlocks. Having accomplished this, a careful manipulation will allow of his bringing up the feet towards the os uteri, and ultimately so to turn the legs as to place them in position of fig. 11; after which, ordinary traction during each throe will enable him to effect delivery with safety, both to the mother and the young.

The above constitute the principal varieties of preternatural presentations; there are, however, some modifications of each, but these will not require from me a further explanation. The rules I have laid down are applicable as general principles, and can be adapted to each particular case.

Besides the methods of extraction which I have spoken of, it will sometimes be necessary, from the great size of the fœtus and other causes, to have recourse to *embryotomy*, or the dissection of the fœtus. In a lecture of this kind it is not to be expected that we can describe this process, which must necessarily differ in almost every instance, and ought never to be undertaken by any but those who have made this subject their especial study. One rule, and only one, I will mention, and that is never to remove a limb *before having dissected back the skin*, so that the various instruments employed may be attached to it, thus securing all the advantages of the limb to exercise traction upon without having the disadvantage of its size.

To the veterinary surgeon I need scarcely say that, varying the position of his patient will materially assist his efforts, and that he is enabled to manipulate with far greater facility when the animal is standing; but whether standing or otherwise, he must not cease his endeavours to adjust the fœtus and accomplish its early removal.

During protracted labour the patient's strength should be supported by diffusible stimulants and cordials, for the expenditure of the vital powers is very great: many cases are lost even after delivery from inattention to this circumstance; good ale, with the addition of some alcoholic spirit, constitutes a most useful agent for the purpose.

When the fœtus has been extracted, no stimulants should be given, as these would bring on inflammatory action; but to quiet the system, a dose of *tinct. opii*, varying from 1 to 2 ounces, ought to be exhibited. The quantity here named will be proper for a mare or cow, a fourth part of which will be sufficient for a sheep. And I should also state that, although my remarks have been chiefly confined to parturition in the cow, still the rules laid down are equally applicable to other animals.

It was my original intention to have spoken of the consequences of parturition and the diseases and casualties immediately connected therewith, but having already exceeded the limits of an ordinary lecture, I must bring our observations to a close, thanking you sincerely for the kind attention I have received, and expressing a hope that the principles I have laboured to expound will hereafter prove of advantage in regulating your proceedings in these difficult and dangerous cases.

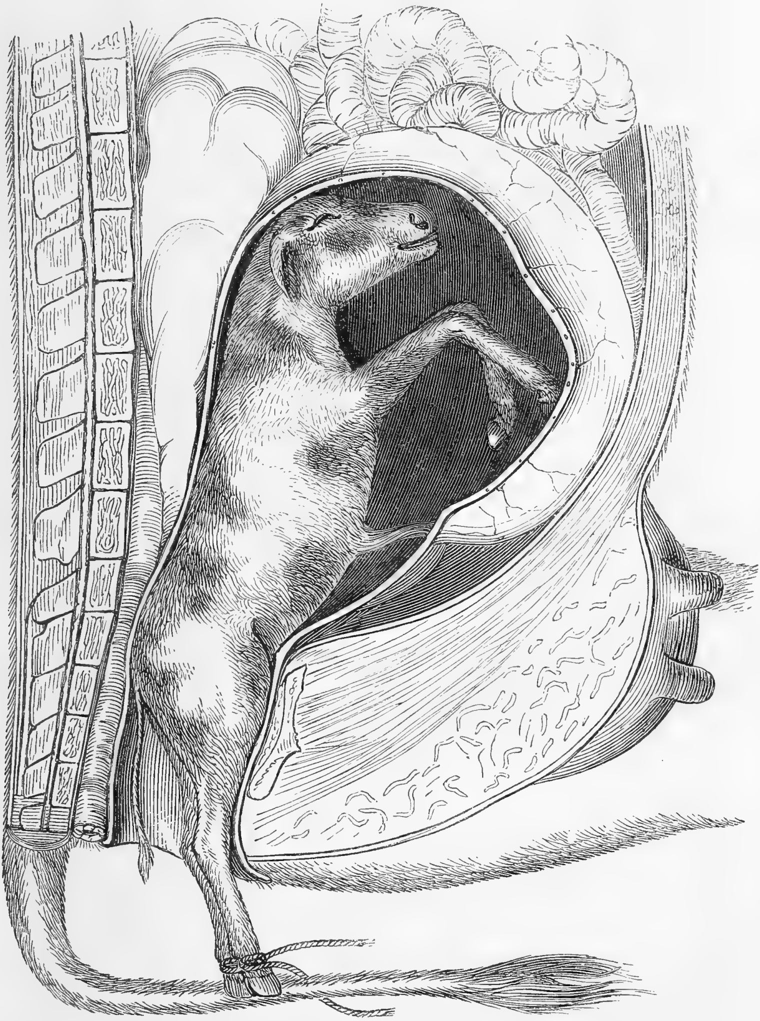


Fig. 11.

XV.—*Agricultural Chemistry—Sheep-Feeding and Manure.*
Part I. By J. B. Lawes.

A prominent feature in the best agriculture of Great Britain is the concentration of produce on the land, by means of the purchase of cattle-food or direct manures; and it may safely be affirmed that, with a rapidly increasing population and a limited area of land, this system must become more and more general if the enhanced demand for human food is to be in any degree adequately met by the supplies of the British farmer. The importance to him, therefore, of a clear conception of the nature and sources of value of manuring substances generally, as well as of the characteristic differences or identity of those derived from the various resources at his command, will at once be obvious; yet, it will be admitted that even the most intelligent and observant practical farmer is far from possessing that clear and definite conception of the *rationale* of the practices he adopts, which alone can prove an unerring guide in his operations, and ensure such conduct of them in detail as is consistent with true economy, and calculated to yield the full advantages which a perfect application of their inherent principle must attain. Much has, however, been done of late years, both by societies and individuals, towards providing that basis of facts without which fixed principles in agriculture, and a right understanding of the practices already approved by experience, cannot be attained; yet, much remains to be done before even the more general and fundamental usages can be satisfactorily explained, whilst the circumstances of their local adaptation may be said to constitute a distinct and not less important, and at the same time more extensive and permanent, field of inquiry.

The growth of green and fodder crops, to be consumed by animals upon the farm, is recognised as a most important source of manure, and it is decided by the practice of the best farmers, that the full advantages which such a course is competent to yield are only attainable when it is aided by the purchase of foreign food for home consumption, or by the direct supply of purchased manure, and it is indeed probable that increased production at home is far more necessarily dependent on the accumulation of material from external resources than is usually supposed. Before, however, the exact economical effects of alternate cropping, the consumption upon the farm of roots or other home productions, or of purchased food, or the supply of foreign manure, can be clearly appreciated or explained, much precise information has yet to be provided, as to the chemical circumstances connected with the growth and appropriation of the more important plants which enter into rotation, and the employment of food and manure from abroad; and the investigation which we have in progress has been designed more especially with a view to providing data which may legitimately serve to elucidate these more fundamental practices of an improved agriculture. The more important questions connected with such an inquiry relate—to the conditions required for the growth of wheat and the allied cereal grains, which constitute so material a proportion of the saleable products of the farm, and the nature of the exhaustion resulting from their growth and export—to the growth, and sources of restorative influence, of root-crops—to the growth of the more important agricultural plants of the leguminous family, both those which are cultivated for their seeds, perhaps to be sold off the farm, such as beans, peas, &c., and those, such as clover, trefoil, vetches, &c., which are supposed to be employed in the production of meat and manure—and, to the chemical circumstances involved in the consumption of food by animals upon the farm, whether of home or foreign growth.

With respect to the first two of these branches of the inquiry, we have already laid before the readers of this Journal many of the results of our experiments relating to them, and in the course of their discussion have endeavoured to show their bearings upon the general principles of agriculture, so far as they seemed to be indicated by a consideration of the facts adduced; and also, to direct attention to the more immediate and direct useful application of them to such of the details of practical farming as they tended to explain and enforce. Both before and since the publication of our former papers many additional facts relating to the subjects respectively of which they treat have been accumulated, which, when leisure is found to complete and arrange them, we hope to make the subject of future communications. Before doing so, however, it seems desirable to give some account of the results obtained in connexion with the other two branches of the investigation; and, although neither that relating to the chemical circumstances of the growth, the uses, and the adaptations in a system of alternate cropping, of the leguminous plants, nor that having reference to the consumption of food on the farm as a source of meat and manure, are at present in that state of forwardness which will admit of so full an application of them as we could wish, yet it is thought that a consideration, especially of those relating to the production of meat and manure, will add something to the information already at command on the subject, and serve to give an useful direction to the observations and conceptions of the intelligent farmer respecting it.

We propose then, in the present article, to give an account of some carefully conducted experiments, undertaken with the view of ascertaining, what becomes of food when consumed by animals upon a farm, and in what form, and in what proportions, some of their most important constituents come to be available for the market—thus taking into account the quantities and qualities of the manure obtained, as a consideration by no means less essential in estimating the comparative value of different foods, than that of the amount of meat produced. Looking at the subject in this point of view, it has not been our special aim so much to determine between one food and another *as such*, or between this or that mode of preparation, as to select those the general value and applicability of which are well recognised. Some information on these points will nevertheless be afforded by our results; and, as the question of the comparative feeding values of barley and malt has of late been much discussed, several comparative trials have been made with them, and the results of these will be more fully detailed and considered than would otherwise have been necessary, on account of the general interest at present excited by the subject.

The experiments upon feeding were commenced early in 1847, and bullocks and pigs were the animals first selected. It was soon found, however, that the former were in several respects ill suited to our purpose. Owing to their great bulk, and the large amount of food consumed and of manure produced, it was impracticable to keep such a number under exact experiment at the same time as would ensure anything like an average constitution of animal, and it was deemed unsafe and useless to rely upon the results of a single animal on each description of food. Bullocks, moreover, are sometimes very unmanageable, and as it was essential to our object frequently to put the animals in the scales, this was a material objection; though by usage indeed, those even which are at first the most violent and refractory become comparatively quiet and easy of management. Thus—four bullocks were taken for experiment, of which the first weighing took several hours, yet they were after a short time weighed daily without any difficulty whatever, the animals frequently running playfully into the scales as soon as they were let loose. In consequence however, it is supposed, of too frequent weighings and other sources of disturbance incidental to experiment, these animals gave but a very small increase, and, owing to this circumstance and to the difficulty of fairly sampling, arising from their great bulk and weight, no analyses were made of their food and excrements. The pigs gave a tolerable increase, but no attention was paid to their excrements, as they had not been fed upon ordinary food alone, but upon the dried flesh of the whale which remains after the extraction of the oil, and which is used in Newfoundland as fuel. The animals increased upon it remarkably fast for a time, but it required a considerable dilution with other food, otherwise they soon became surfeited, a fact which is not to be wondered at, considering that the substance contained about 12 per cent. of nitrogen, a circumstance which we shall see as we proceed would be much in favour of its use, so far as the resulting manure is concerned.

Sheep were next taken, which, from their docility and manageable size, are convenient subjects for experiment; and, owing to their very general utility, they seem better fitted than any other description of farm-stock to be assumed as their type, in an investigation of the general chemistry of the production of meat and manure, though at the same time it must be admitted, that it would in some respects have been desirable to have included bullocks also in the inquiry. It being essential to our object to collect, without loss and free from litter or extraneous matter of any kind, the whole of the excrements of the animals, both liquid and solid, to be accurately weighed and sampled for analysis, pens were constructed in a spacious barn, each about 8 feet by 7½ feet, and having a flooring of rafters, on the plan proposed by the Rev. A. Huxtable, the width of the rafters being about 3 inches, and the distance between them about ¾ inch, so as to allow the whole of the excrements to pass through. Below this flooring, which is raised perhaps 2 feet or more above the ground-level, sheet-zinc is fixed at such an incline as to allow the urine to run off, while the dung is retained upon it. The urine passes through a spout into a covered pail kept constantly underneath to receive it, and to which a straining basket is fixed to stop any solid portions that may come down, the dung being removed from the zinc at pleasure for weighing, sampling, &c. The food, of course, was also accurately weighed. This arrangement appears sufficiently simple, and well calculated to attain the end desired, but we shall see as we proceed, that in the details of practice difficulties are met with from which serious errors in result may easily arise, unless great care be taken to avoid them. These sources of error are chiefly connected with the great difficulty of obtaining samples for analysis which shall accurately represent the *bulk* of matters so heterogeneous and variable in their composition as the food and excrements of animals; and when it is remembered that in some processes of analysis a few grains only of substance are operated upon, and that from the composition of these that of the whole is calculated, it will readily be understood, that in an investigation like that in question—which itself constitutes indeed from the beginning to the end one process of quantitative analysis—the greatest care is requisite, if erroneous conclusions are to be avoided. And, that the reader may be enabled to decide as to the legitimacy of such as we shall found upon the results, a full description of the experiments will be given, which moreover may further serve both as guide and monitor to any who may choose to follow in a field of inquiry at present somewhat new.

The sheep employed in the experiments were Hampshire Downs, and the selections were made from large flocks, usually nearly 100 being weighed; from these a few animals of nearly equal weight and apparently equal make were taken, and one put into each pen—a second lot being then taken and divided in the same way, and so on—until each pen contained the desired number. It will nevertheless be seen by the results, that the selections and distributions were in some cases far from satisfactory, and that, although five sheep were placed in each pen, the average result of these can by no means be taken as representing *unconditionally* the relative feeding value of the foods employed.

In the account which we shall now proceed to give of several separate series of experiments, the order adopted will be, to discuss the whole of the results—first, so far as they relate to the production of *gross increase in live weight*—secondly, as to the qualities and composition of the increase obtained—and, thirdly, as to the production of *manure.* We shall then endeavour to give a summary of the more important facts elicited, and to show the connexion between the conclusions to which they may lead, and those arrived at in our former papers,—concluding with some remarks on their general application to the details of practical agriculture.

EXPERIMENTS WITH SHEEP.—*Series* I.

The first series of sheep-experiments was commenced on January 5, 1848, and was continued until April 11, a period of 13 weeks and 6 days. There were 4 of the experimental pens, as described above, employed, into each of which 5 animals were placed, their weights at the commencement being as under.

SERIES I.

TABLE 1.—Showing the Weight of Sheep in pounds, when put up, January 5, 1848.

Numbers of Sheep.	Pen 1.	Pen 2.	Pen 3.	Pen 4.
	lbs.	lbs.	lbs.	lbs.
No. 1 . . .	118½	117½	117	115
2 . . .	112½	112½	114	114½
3 . . .	111	112	110½	112
4 . . .	110	110	110	110¼
5 . . .	106	96	107	95
Total weight per Pen	558	548	558½	546¾

The sheep were brought from the field, where they had been receiving swedes and hay chaff; and, with the exception of the 5th sheep of pens 2 and 4, which appeared however the most eligible at command at the time, the 4 pens seemed to compare sufficiently with each other, so far as weight can be taken as a guide. The results will show, however, that although one of these light sheep soon proved itself unfit for experiment, the other increased considerably more than one of the heavier sheep on the same food, and also more than several of those on the different foods. The *special* foods selected were—for pen 1, oil-cake; for pen 2, oats; pen 3, clover-chaff; and pen 4, oat-straw chaff; besides which, all were supplied with cut swedes as many as the animals chose to eat. Taking 1 lb. of oil-cake per sheep per day, as a fair and ordinary allowance, it would in some respects have been desirable to apportion the other dry foods so as to provide an equal amount of nitrogen in each. The experiments were commenced however before the analyses of the foods had been undertaken, so that no allotment founded on their exact nitrogenous contents could be made, and it was supposed that considerably more than *two* pounds both of oats and of clover would be required to equal 1 lb. of oil-cake in this respect. These quantities would obviously be too great; but it was decided to gain the end approximately, by giving to pen 2 as many oats, not exceeding 2 lbs., and to pen 3 as much clover-chaff, not exceeding 2 lbs. per sheep per day, as the animals would eat, and to pen 4 oat-straw chaff *ad libitum*. It was found, however, that even the oil-cake was not eaten to the full amount provided; and, as might be expected, that the consumption of oats, and clover-chaff, did not nearly approach that required to equal in supply of nitrogen that of 1 lb. of oil-cake; whilst, the oat-straw chaff was taken to such a small extent, that its use was entirely discontinued after a few weeks.

In the following table are given the average weekly consumption of food per sheep in the several pens, and the pounds weight of increase of each animal between each period of weighing (chiefly weekly intervals), throughout the course of the experiments. Wherever the minus sign (—) occurs before a figure, *loss instead of gain* is indicated.

The statement of the results thus in all their detail is useful, exhibiting as it does the liability to error in judging of the feeding value of different foods, or of the disposition to increase of animals of different descriptions, unless both a sufficient number of animals are experimented upon, and the trial be extended over a considerable period of time. By a glance down the columns of the table it is seen, that there is not a sheep which does not during one or more, sometimes consecutive periods of the experiment, show a gain of 4, 5, or even 6 or 8 lbs. in a week, whilst at another period it apparently gains nothing at all, or even loses weight. It is perhaps scarcely necessary to observe, that these

SERIES I.

TABLE 2.—Showing the Average Weekly Consumption of Food per Sheep in each Pen, the pounds Weekly Gain or Loss of each animal, the weekly average for each Pen, and the total and mean weekly gain of each animal throughout the period of the experiment.

Periods.			PEN 1. Average Food per Week per Sheep. Oilcake, 6½ lbs.; Swedes, 89¾ lbs.						PEN 2. Average Food per Week per Sheep. Oats, 8½ lbs.; Swedes, 82¼ lbs.					
From	To	No. of Days.	Sheep Numbers.					Weekly average gain or loss per Sheep.	Sheep Numbers.					Weekly average gain or loss per Sheep.
			1.	2.	3.	4.	5.		1.	2.	3.	4.	5.	
Jan. 5	Jan. 18	13	11½	7½	7	3	5	3·7	13½	12	11	1	6	4·7
18	25	7	3	½	4	2½	2	2·4	½	− 1	1½	5	−1½	0·9
25	Feb. 1	7	2	4½	1	1½	0	1·8	2	2½	0	− 1	2½	1·2
Feb. 1	8	7	3	3½	2½	2	1½	2·5	½	3	1½	½	2	1·5
8	15	7	2	2½	1	½	½	1·3	½	2½	4	3	2	2·4
15	22	7	3	1	4½	1	2	2·3	3½	2½	4	2½	5	3·5
22	29	7	0	4	0	− ½	− 4	−0·2	2	2	− 2	− 2	0	0·0
29	Mar. 7	7	5	4	5	2	−13	0·6	5	4	3	3	6	4·2
Mar. 7	14	7	− ½	− 2	½	½	0	−0·3	3½	2	6	4	2	3·5
14	21	7	2½	8	1½	3½	12	5·5	4½	5	1	0	5	3·1
21	28	7	− 1	− 2	0	− 3	1	−1·0	0	− 2	− 2	− 3	− 2	−1·8
28	Apr. 4	7	2	1	4	− 1	3	1·8	0	1	0	− 6	1	−0·8
Apr. 4	11	7	4	2	1	1	4	2·4	0	2½	4	4	− 1	1·9
Totals.		97	36 5	34 5	32 0	13 0	14 0		35 5	36	32	11	27	
Means.			lbs. oz. 2 9¾	lbs. oz. 2 7½	lbs. oz. 2 4½	lbs. oz. 0 14¾	lbs. oz. 1 0	lbs. oz. 1 14	lbs. oz. 2 8½	lbs. oz. 2 9	lbs. oz. 2 4½	lbs. oz. 0 12½	lbs. oz. 1 14¾	lbs. oz. 2 0¼

Periods.			PEN 3. Average Food per Week per Sheep. Clover Chaff, 8¼ lbs.; Swedes, 116 lbs.						PEN 4. Average Food per Week per Sheep. Oat-straw Chaff, ½ lb.; Swedes, 120¼ lbs.					
From	To	No. of Days.	Sheep Numbers.					Weekly average gain or loss per Sheep.	Sheep Numbers.					Weekly average gain or loss per Sheep.
			1.	2.	3.	4.	5.		1.	2.	3.	4.	5.*	
Jan. 5	Jan. 18	13	2	8	9	8½	11½	4·2	6	5¾	4	4¾	− 7	2·7
18	25	7	3	3½	4½	− 1	3½	2·7	− 1½	− 2¼	½	1¼	− 4	0·43
25	Feb. 1	7	4	2¼	3	3½	5	3·5	2	1	2½	½	½	1·5
Feb. 1	8	7	½	3¼	¾	2	5	2·3	3½	3½	½	6	..	3·4
8	15	7	− 4	− 1	− 2¼	0	− 4	−2·2	1	½	1	− 3½	..	0·2
15	22	7	5½	3	4½	5	8	5·2	6	3½	2	5	..	4·1
22	29	7	1½	2½	− 1	− 2	0	0·2	− 7	− 3½	½	− ½	..	−2·6
29	Mar. 7	7	5½	3½	4	4	4	4·4	8	7	2	2	..	4·7
Mar. 7	14	7	1	− 1	1½	4	1½	1·4	− 2	1	− 1	− 1	..	0·7
14	21	7	4	4	2½	2	4½	3·4	4	6	3	5	..	4·5
21	28	7	0	0	0	− 1	0	−0·2	0	− 3	− 1	− 2	..	−1·5
28	Apr. 4	7	4	0	1	4	2	2·2	− 1	0	0	2	..	0·2
Apr. 4	11	7	− 2	2	0	2	1	0·6	2	4	− 2	− 1	..	0·7
Totals.		97	25	30	27½	31	42		21	23½	12	18¾		
Means.			lbs. oz. 1 12½	lbs. oz. 2 2¼	lbs. oz. 1 15½	lbs. oz. 2 3½	lbs. oz. 3 0	lbs. oz. 2 3¾	lbs. oz. 1 8	lbs. oz. 1 10¾	lbs. oz. 0 13¾	lbs. oz. 1 5½	lbs. oz.	lbs. oz. 1 5¾

* Sheep No. 5, Pen 4, lost weight considerably from the commencement, and being evidently very unwell, was removed from the pen after the third week, and fed upon better food; its increase is therefore omitted from the table.

variations mainly depended on the amount of the matters of the food retained at the time in the stomach and intestines of the animals, an irregularity which was guarded against as far as seemed practicable without imposing unnatural restraints upon the animal, the plan adopted being, to weigh them always about the same hour of the day, and just before their second meal of dry food, their troughs being, however, constantly supplied with turnips. This variation is indeed a source of error which it is very difficult to control, and it is probable that many of the published results of very rapid increase are subject to objection on account of it. The fluctuation, as would be supposed, seems to occur nearly as prominently with those sheep which in the main show a good result as with the rest; and, although there is nevertheless considerable difference, yet there is, excluding the extreme cases of loss or gain of individual sheep, to an extent an uniformity throughout each pen at the several periods, and even between pen and pen, as a view of the columns of weekly average gain or loss in each, placed side by side, will show.

SERIES I.

TABLE 3.—Showing the Weekly Average Gain or Loss per Sheep in each Pen throughout the course of the experiments.

PERIODS.			Weekly Average Gain or Loss per Sheep in pounds and tenths.			
	From	To	Pen 1.	Pen 2.	Pen 3.	Pen 4.
1	Jan. 5	Jan. 18	3·7	4·7	4·2	2·7
2	18	25	2·4	0·9	2·7	0·4
3	25	Feb. 1	1·8	1·2	3·5	1·5
4	Feb. 1	8	2·5	1·5	2·3	3·4
5	8	15	1·3	2·4	−2·2	0·2
6	15	22	2·3	3·5	5·2	4·1
7	22	29	−0·2	0·0	0·2	−2·6
8	29	Mar. 7	0·6	4·2	4·4	4·7
9	Mar. 7	14	−0·3	3·5	1·4	0·7
10	14	21	5·5	3·1	3·4	4·5
11	21	28	−1·0	−1·8	−0·2	−1·5
12	28	April 4	1·8	−0·8	2·2	0·2
13	April 4	11	2·4	1·9	0·6	0·7
			1·8	1·9	2·1	1·5

Thus it is seen that during the 1st, 4th, 6th, 8th, and 10th periods, there is *throughout the pens* a general disposition to more than the average increase, especially at periods 1, 8, and 10, excepting in pen 1, but on reference to the details it will be found that the small average of pen 1 at the two latter periods, depended upon a considerable loss of one single animal which was so unwell as to require removal and change of food for a time. Again, at periods 5, 7, 9, and 11, there is throughout the pens a gain much below the average, or even a loss, the cases rather exceptional being pen 2 at periods 5 and 9; on the other hand the uniformity is most striking at periods 7 and 11; at the former, pen 3 is the only gainer, to the small extent of 0·2 lb., pen 1 losing that amount, and pen 4 considerably more; whilst at period 11 there is a loss of weight in every pen. Considering the uniformity as to time and circumstances of weighing, it is scarcely likely that these results are attributable to an irregular allotment of food on the days of weighing, but is more likely to be dependent on the state of the weather as to temperature and other circumstances, so influencing the appetite, the action of the lungs, the liver and the circulation, as materially to affect the temporary amount of the contents of the alimentary cavities and passages. A reference, however, to the exact amount of food consumed, and to the maximum, minimum, and mean temperatures during the several periods—whilst it is not without interest as bearing upon these points—does not so satisfactorily account for the facts observed, as to justify a full consideration of them in this place. The remarks already made, however, will serve some useful purpose, if they direct the attention of other experimenters to sources of errors which have not unfrequently been overlooked, and which, if not avoided, are in danger of leading the farmer sadly to miscalculate in reference to a very important branch of his operations.

The following summary will bring to view the average weekly increase of each animal upon the same and the different foods, for the entire period of 13 weeks and 6 days:—

SERIES I.

TABLE 4.—Showing the Average Weekly Increase of each Sheep for the entire period of the Experiment. Quantities stated in Pounds and Ounces.

Pen Nos.	Average Weight of Sheep at commencement.	Food consumed per Week per Sheep.	Average Weekly Increase of each Sheep in pounds and ounces.					Mean Weekly Increase in each Pen.
			Sheep, No. 1.	Sheep, No. 2.	Sheep, No. 3.	Sheep, No. 4.	Sheep, No. 5.	
Pen	lbs.		lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.
1	111½	Oilcake, 6½ lbs.; Swedes, 89¾ lbs. . .	2 9¾	2 7½	2 4½	0 14¾	1 0	1 14
2	109½	Oats, 8½ lbs.; Swedes, 82¼ lbs. . .	2 8½	2 9	2 4½	0 12½	1 14¾	2 0½
3	111¾	Clover Chaff, 8¼ lbs.; Swedes, 116 lbs. .	1 12½	2 2¼	1 15½	2 3½	3 0	2 3¾
4	113	Swedes, 120¼ lbs.; Oat-Straw Chaff, ½ lb.	1 8	1 10¾	0 13¼	1 5½	. .	1 5¾

Such is the variation between one sheep and another as shown in the Table, that taking the results of each pen collectively, little exact information can be obtained from them respecting the relative value of the different foods as meat-producers. In pen 1 with oil-cake, there are 2 sheep giving an amount of increase considerably less than half that of the other 3 on the same food. In pen 2 with oats, there is one animal scarcely exceeding 1-3rd the mean increase of the other 4. In pen 3 the clover-chaff does not give a single bad result, and owing to a comparatively large gross increase in one case (which, as we shall afterwards see, was an over estimate of the real progress), gives the highest mean of all the pens. As has been observed already, the oat-straw chaff was almost entirely refused by the sheep of pen 4, and it was therefore discontinued after 4 weeks' trial. One of the animals, moreover, No. 5, lost from the commencement, and it was removed unwell from the experimental pen after the 4th week, but recovered on better diet. The 4 remaining, give, as might be expected, an increase very inferior to the mean of the other pens, and the result can scarcely be fairly compared with them.

Setting aside pen 4, the mean increase of the first 3 pens, taken together, is believed to be a fair practical result; and it is probable that such variations upon the same food as have been noticed are by no means uncommon, and although they arise chiefly from variations in constitution, and cannot therefore be attributed to the food consumed, yet it is probable that they will be more likely to exhibit themselves under a high than under an inferior diet, provided this be not deficient.

In endeavouring to estimate the comparative feeding value of the several descriptions of food with such a small number of animals on each, and with such variations among them, perhaps the truest indication will be obtained, by excluding those sheep which appear to have been unhealthy, or at least ill adapted to food, the general value of which is fully recognised. Leaving out of view then the 2 sheep of pen 1 before mentioned, one of which was at one period so unwell as to require removal for a time, and the single sheep in pen 2 whose increase was so far below the average, we shall find that the oil-cake had given the best increase, the oats coming 2nd, and the clover-chaff 3rd. It is, however, chiefly as showing the probable average increase obtainable from a given amount of foods of known value and common utility, rather than as pointing out any nice distinctions between them, that the results are useful.

In the next Table are given the results of analyses of the various foods, by which we shall be enabled to estimate the amounts of some of the more important constituents consumed.

The large quantities of the foods operated upon will surprise those accustomed to ordinary laboratory processes. It has been found, however, that the composition of most agricultural substances is so heterogeneous, as to require that special attention be paid to the averaging and preparation of the specimens; and, that it is necessary to take from the bulk with great care somewhat large quantities in the first instance, more especially of roots and other succulent or moist substances. These, if necessary, are partially dried, to render them capable of being finely divided

SERIES I.

TABLE 5.—Showing the per Centages of *Dry Matter*, *Ash*, and *Nitrogen*, in the Foods.

Description of Food, particulars of Sampling, &c.					Per Centage results.					
Description of Food.	Period of Consumption.		Particulars and Date of Sampling.	Fresh Weight taken for Drying, &c.	Dry Matter.		Ash.		Nitrogen.	
	From	To			Inclusive of Ash.	Organic only.	In fresh substance.	In dry matter.	In fresh substance.	In dry matter.
				lbs. oz.						
Swedes, No. 1.	Jan. 5	Feb. 4	From the field, Dec. 1847	43 2¾	10·58	10·002	0·577	5·458	0·263	2 49
Swedes, No. 2.	Feb. 4	Apr. 11	Clamped, Nov. 1847; Sampled, Feb. 9, 1848	14 8½	12·12	11·49	0·632	5·214	0·151	1·25
				oz.						
American Oil-cake	Jan. 5	Apr. 11	At commencement	50	89·50	84·08	5·420	6·060	5·083	5·68
Oats . . .	Jan. 5	Apr. 11	At conclusion.	25	85·18	82·24	2·940	3·450	2·078	2·44
Clover Chaff .	Jan. 5	Apr. 11	From large quantity cut at commencement	100	78·61	72·33	6·280	7·990	1·847	2·35
Oat-Straw Chaff	Jan. 5	..	..	25	81·28	84·86	6·418	7·870	..	..

and well mixed, and smaller proportional amounts are then taken if required for fully drying and burning; a portion being reserved for organic analysis. It will be seen, however, that notwithstanding these precautions, we have in some cases fallen short of the desired result. The dryings and burnings are accomplished by means of apparatus arranged specially for the conduct of these processes on the scale required in agricultural investigation. The drying-bath consists of a double-cased iron box with water between, heated by a furnace underneath, the internal dimensions being about 5 feet 6 inches length, by 2 feet 6 inches width, and 18 inches height. The burnings are conducted on sheets of platinum placed in a series of cast-iron muffles about 16 inches in length, about 5 in width, and 3 to 4 in height, which are so fitted into a cast-iron furnace, heated by coke, as to prevent any dust whatever from the fire getting into them, a gentle yet sufficient draft over the surface of the burning substance being secured by means of a chimney of iron piping, fixed into the back of each of the muffles, and projecting some height externally to the furnace.

Referring to the results of the Table, it is worthy of remark, that the swedes No. 1, which were consumed from January 5 to February 4, had a per centage of nitrogen nearly double that of swedes No. 2, which were commenced at the latter date, and lasted to the end of the experiment. The former were part of an experimental crop grown by rape-cake, ammoniacal salt, and superphosphate of lime; the latter were grown in the ordinary course of farming from farm-yard dung and superphosphate of lime. We have shown in a former paper in this Journal, the effect of nitrogenous manures in increasing the per centage of nitrogen in the white turnip, and the results given above, support the supposition that the composition of the swede turnip is influenced in the same way. It is probable, however, that a part of the result may be due to a difference in the stage of maturity, and to the circumstances of storing in the two cases. Weight for weight the oil-cake is seen to contain more than twice as much nitrogen as either the oats or the clover; the latter is the poorer of the two in that respect, and also so far as dry organic matter is concerned, and this latter moreover in the clover would probably consist to a much greater extent of inert woody fibre, which would pass through the animal unchanged, than in the oats. The clover, however, contains a much larger per centage of mineral matter.

Below are arranged side by side the total amount of fresh food—of dry organic matter—of mineral matter—and of nitrogen (the three latter calculated from the data provided in the last Table), consumed in each pen during the entire period of 14 weeks; also the total increase of live weight obtained at their expense, from 5 sheep in the first 3 pens, and from 4 in the 4th pen.

SERIES I.

TABLE 6.—Showing the Amount of Food or Constituents consumed, and of Increase produced.

	Total Increase in Live Weight.	Description and Quantities of Food consumed in each Pen in 14 Weeks.	Total Dry Organic Matter consumed.	Total Mineral Matter consumed.	Total Nitrogen consumed.	Nitrogen in Increase at 3 per cent.	Nitrogen in Increase, to 100 consumed.
	lbs.		lbs.	lbs.	lbs.	lbs.	lbs.
Pen 1. 5 Sheep.	131½	Oilcake, 456½ lbs. . . .	383¾	24¾	23¼	3·9	11·14
		Swedes, 6286 lbs. . . .	691¼	38½	11¾		
		Total . .	1,075	63¼	35		
Pen 2. 5 Sheep.	143	Oats, 598 lbs.	491¾	17½	12½	4·3	18·43
		Swedes, 5756 lbs. . . .	633	41¼	10¾		
		Total . .	1,124¾	58¾	23¼		
Pen 3. 5 Sheep.	157	Clover Chaff, 578 lbs. . .	418	36¼	10¾	4·7	18·43
		Swedes, 8121½ lbs. . .	899	50	14¾		
		Total . .	1,317	86¼	25½		
Pen 4. 4 Sheep.	76	Oat-Straw Chaff, 29¼ lbs. .	24¾	1¾		2·3	18·77
		Swedes, 6742 lbs. . . .	747	41½	12¼		
		Total . .	771¾	43¼	12¼		
19 Sheep.	507½	For the 4 Pens . .	4,288½	251½	96	15·2	15·83

The actual amount of nitrogen contained in the gross increase in live weight of an animal fed upon food containing a given amount of that substance, cannot of course be experimentally ascertained; it is believed, however, that the estimate of 3 per cent., by which the last 2 columns of the Table are arranged, is not wide of the truth, though it is more probably too high than too low, as we shall have occasion to show further on. Assuming the figures as given in the Table to be correct, it is seen, that by the feeding of 19 sheep for 14 weeks, during which time they consumed 1662 lbs. of dry food, and 26,905 lbs. of swedes, containing together 96 lbs. of nitrogen, only 15¼ lbs. of that element are obtained in the increase of weight produced. We learn too from the Table, that although the actual amount of nitrogen consumed in pen 4 was only one half that in pens 2 and 3, yet the amount of nitrogen retained by the animal to 100 consumed is almost identical in the three cases, thus indicating a close connexion between the amount of nitrogen in the food, and that of increase produced. It is possible that the actual per centages given may not be correct, yet the relation of the amounts to each other is probably a pretty close representation of the truth. It would appear, however, that the sheep upon oil-cake, although they consumed a larger amount of nitrogen in their food than those in either of the other pens, yet they gave an increase not only less in actual amount, but far less in proportion to the nitrogen consumed, than those in either of the other pens. This result is partly due to taking into the calculation the 2 sheep which increased so very much less than the rest; yet other experiments seem to show, that however important to the progress of the animals a large amount of nitrogen in their food may be, their increase will by no means be unconditionally in direct *numerical* proportion to the amount of the nitrogen consumed, especially when this is increased beyond a certain limit.

With the exception of the last two columns, of which chiefly we have been speaking, the figures in the preceding Table represent the actual experimental results obtained. For more convenient reference, however, and for the study of the general bearing of the facts as to the probable amount of food or constituents required to produce a given effect, they are arranged in Tables 7 and 8, which follow, so as to show the weekly consumption in each pen by every 100 lbs. of live-weight of animal, and also the amount consumed to produce 100 lbs. of *increase*. Before leaving Table 6, however, we may remark, that of the mineral matter consumed, there were in the 1st pen 60·8 per cent., in the 2nd 70·2 per cent., in the 3rd 57·9 per cent., and in the 4th 95·9 per cent. derived from the home-produced root-crop, the remainder being due to the dry, purchased or marketable food.

SERIES I.

TABLE 7.—Showing the Average Weekly Consumption of Fresh Food, of Dry Organic Matter, of Mineral Matter, and of Nitrogen, by each 100 lbs. live-weight of Animal. Quantities stated in pounds, tenths, &c.

	Description of Special Foods.	Fresh Food consumed.			Dry Organic Matter consumed			Mineral Matter consumed			Nitrogen consumed		
		Special Food.	Swedes.	Total Food.	In Special Food.	In Swedes.	In Total Food.	In Special Food.	In Swedes.	In Total Food.	In Special Food.	In Swedes.	In Total Food.
Pen 1.	Oilcake	5·23	72·06	77·29	4·39	7·92	12·31	0·28	0·43	0·71	0·26	0·13	0·39
Pen 2.	Oats	6·87	66·43	73·30	5·64	7·30	12·94	0·20	0·40	0·60	0·14	0·11	0·25
Pen 3.	Clover Chaff . . .	6·48	91·15	97·63	4·68	10·08	14·76	0·40	0·55	0·95	0·11	0·15	0·26
Pen 4.	Oat-Straw Chaff . .	0·42	98·32	98·74	0·35	10·89	11·24	0·02	0·59	0·61	..	0·17	0·17
Mean of Pens 1, 2, and 3 . .		6·19	76·54	82·74	4·90	8·43	13·33	0·29	0·46	0·75	0·17	0·13	0·30

TABLE 8.—Showing the Average Consumption of Fresh Food, of Dry Organic Matter, of Mineral Matter, and of Nitrogen, to produce 100 lbs. *Increase* in live weight. Quantities stated in pounds.

	Description of Special Foods.	Fresh Food consumed.			Dry Organic Matter consumed			Mineral Matter consumed			Nitrogen consumed		
		Special Food.	Swedes.	Total Food.	In Special Food.	In Swedes.	In Total Food.	In Special Food.	In Swedes.	In Total Food.	In Special Food.	In Swedes.	In Total Food.
Pen 1.	Oilcake	347	4779	5126	291¾	525½	817¼	18·80	29·32	48·12	17·63	8·96	26·59
Pen 2.	Oats	418	4024	4442	343¾	442½	786¼	12·28	24·69	36·97	8·68	7·56	16·24
Pen 3.	Clover Chaff . . .	368	5172	5540	266	572½	838½	23·11	31·87	54·98	6·79	9·44	16·23
Pen 4.	Oat-Straw Chaff . .	38	8871	8909	32¼	982¾	1015	2·43	54·31	56·74	..	16·13	16·13
Mean of Pens 1, 2, and 3 . .		377	4658	5035	300½	513½	814	18·06	28·62	46·68	11·03	8·65	19·68

In explanation of the construction of Table 7, it should be observed, that the live weight, which is supposed to have consumed the total food in each pen, as given in Table 6, is the mean of the weight throughout the entire period of the experiment, obtained by adding together the total weight in each pen at the commencement and at the end of the experiment, and dividing by 2.* It may be well also here to mention, as affecting the correctness of Tables 7 and 8—and, indeed, Table 6 also, though the subject will be again referred to—that the samples of swedes No. 1 were taken direct from the field on the day they were carted from the land, a short time previous to the commencement of their use, and those of swedes No. 2, also near to the commencement of their consumption; so that, if, as we have shown in a previous paper, a considerable exhalation of water takes place from roots and other succulent substances after they are gathered in, it is evident that the quantities weighed out to the animals, after being cut day by day as the experiment proceeded, would represent a larger amount of the fresh swedes such as came to the feeding-shed than was indicated by the scales. Indeed, it is to be feared that the amounts of *dry matter* and of *nitrogen* in the swedes, are from this cause estimated too low in the Tables given above; and, judging by the aid of other results since obtained, it is supposed that they ought to be raised by about one-sixth of the total amount of those substances stated as contained *in the swedes.* Supposing the error to exist, it would not materially affect the correctness of any observations we shall hazard respecting the results, though its probability will certainly add to reasons already suggested for the exercise of caution in founding any nice calculations upon them. It is thought better thus to give the results as they were actually obtained, with such observations as may indicate in what respects they may be subject to error, than arbitrarily to amend them, upon data which are uncertain.

With these precautionary remarks we may safely call attention to the fact, that whether we take the figures as given in the Tables, or consider them amended, it would seem that there was very nearly the same amount of gross dry-organic-matter consumed weekly by 100 lbs. of live weight of animal in all the pens; and when we consider that in the 3rd pen with clover, which gives the highest amount, there would be a larger proportion of it inert woody fibre, which would pass through the animals unchanged, than in any of the other pens, and that in the 4th pen, which gives the least dry-organic-matter consumed, the swedes only would probably contain less effete matter than the mixed foods in

---

* This rule is applied in all the cases of a similar kind occurring in this article.

the other cases, it would appear that the amounts of really digestible dry organic food were almost identical in the four cases. The amount of nitrogen, on the other hand, which is consumed by a given weight of animal within a given time, varies exceedingly in the four pens: there being to 100 lbs. live weight per week, 0·39 lb. in pen 1, 0·25 lb. in pen 2, 0·26 lb. in pen 3, and 0·17 lb. only in pen 4. If we now turn to Table 8, however, we shall see that the amount of nitrogen required to produce a given increase of weight was almost identical in pens 2, 3, and 4, with oats and swedes, clover and swedes, and swedes only, respectively: whereas in pen 1, with oil-cake, in which by far the largest amount of nitrogen was consumed within a given time, a less effect was produced by a given amount of it. It would thus appear that *consumption* is regulated much more by the amount of available *non*-nitrogenous substance in the food than by that of nitrogen; whilst the *increase* would seem to bear a much more direct relation to the quantity of *nitrogen* consumed, when this does not exceed a certain limit—beyond which, however, the proportional effect would appear to be lessened. From Table 8, again, we gather that although, in pen 4 with swedes alone, a given amount of nitrogen produced an effect equal to that of any of the other foods, yet this would seem to have been attained at the cost of a larger consumption of available *non*-nitrogenous food; for not only is the gross amount of dry-organic-matter consumed to produce 100 lbs. increase greater in pen 4 than in any of the others, but it is supposed that less of it would be necessarily at once effete than in any of the other cases. From these facts we learn, that, so far at least as the production of increase is concerned, the nitrogenous constituents were, in pen 1 with oil-cake, in excess over the available *non*-nitrogenous ones; whilst in pen 4, on the other hand, where swedes alone were given, they were in defect.

Turning to the general rather than to the particular facts brought to view, we find—taking the average results of 15 sheep fed for 14 weeks on oil-cake, or oats, or clover-chaff, and swedes, as shown in the bottom line of Table 7—that every 100 lbs. live weight of animal consumed weekly 6¼ lbs. of the special foods, and 76½ of swedes, which contained together 13⅓ lbs. of dry-organic-matter, ¾ lb. of mineral matter, and 0·3 lb. (about 5 oz.) of nitrogen; and from Table 8 we learn that 377 lbs. of the special foods and 4658 lbs. of swedes—the two containing 814 lbs. of dry-organic-matter, 46¾ lbs. of mineral matter, and 19¾ lbs. of nitrogen—were required to produce 100 lbs. increase in live weight. The results of pen 4 are excluded from this estimate, as the food consumed in it, being almost wholly swedes, can scarcely be compared with those of the other pens, nor was it, like them, such as is usually considered sufficient for animals preparing for the butcher.

We have now given an account of the first series of experiments with sheep, so far as they relate to the production of increase in *gross live weight* of animal, to which point we for the present confine our attention. In so doing it has been our endeavour to arrange them in such form as would be convenient for their study, and to make such remarks respecting them, as may serve usefully to direct the attention of the reader to the chief points of interest in the results; at the same time pointing out several sources of irregularity, which seem to demand that great caution should be exercised both in the conduct and the interpretation of such experiments.

We shall now proceed to consider the results of a second series, in relation, first, also to that branch of the subject to which alone we have as yet referred—viz. that of the production of *gross live weight;* leaving the question of the probable qualities or composition of the increase obtained, for consideration further on, in reference to all the series collectively.

EXPERIMENTS WITH SHEEP.—*Series* II.

This series, like the former one, comprised 4 pens of 5 sheep each. On June 5, 1848, 80 yearling wethers (part of a flock of 200) were weighed, from which the selection was made. In matching the animals in sets of 4, for the distribution of one of them into each pen, attention was paid rather more to the breed and make than to actual identity in weight, any discrepancy in respect to the latter in one distribution, being compensated for, as far as possible, in the next; so that eventually a sufficiently equal weight was obtained in each pen, as the following Table will show:

SERIES II.

TABLE 1.—Showing the weight of sheep in pounds when put up, June 5, 1848.

Sheep Numbers.	Pen 1.	Pen 2.	Pen 3.	Pen 4.
	lbs.	lbs.	lbs.	lbs.
No. 1 . . .	120	125	122	117
2 . . .	124	123	117	122
3 . . .	125	117	120	120
4 . . .	121	123	118	119
5 . . .	117	119	125	124
Total weight per Pen	607	607	602	602

The sheep having corresponding numbers in the several pens do not agree here so well as in the former series. The result will show, however, that the selection was probably somewhat an improvement upon the last; at least, with one or two exceptions, the variations upon the same food are much less, and do not so seriously interfere with the legitimacy of the comparisons between pen and pen, unless, indeed, moderate uniformity be insufficient to give confidence in results obtained from so small a number of animals in each case. It should be mentioned, however, that No. 5 sheep, in pen 1, fell ill and died in the fifth week of the experiment, when his place was supplied by another from the same flock, having a weight the same as the one which was taken away before it had lost by the attack of illness.

Whilst, as we have before stated, the primary object of the experiments was not alone to decide the comparative value of different yet allied descriptions of food, as such, the selection of foods was nevertheless made in the hope that some interesting facts bearing upon such points might be ascertained; and those taken were—for pen 1, oil-cake; pen 2, linseed; pen 3, barley; and pen 4, malt. It would have been desirable to have given green clover, or tares, or some other summer green crop, as the complementary food, such constituting the usual practice at the period of the year at which the experiments were made. But as such substances are even more variable and changeable in their composition than roots, particularly as to the amount of dry matter they contain, it was decided that it would be quite impracticable so to supply such food as to obtain a trustworthy estimate of the actual amount of dry solid matter consumed, and as the accurate determination of this point was essential to our object, there was no alternative but to supply dry hay, the composition of which would vary little, compared with that of any other substance at command. Clover-chaff was therefore taken, free allowance of water being of course necessary. It may be objected that the supply of dry food only, with water, was not in all respects favourable to the progress of the animals; it is, indeed, more than probable that a larger increase would have been obtained upon other food; but the results by no means lead to the conclusion that they are far short of such as are frequently met with in practice, or that the value of the comparative indications is thereby lessened.

In the absence of previous knowledge by analysis of the composition of the food, it was considered desirable to give to each sheep 1 lb. per day of the special foods, as this was about the quantity that would be given of them in ordinary practice. It was found, however, that the sheep receiving malt would not eat it well at first, though afterwards they did so. The clover-chaff was allowed to all, in any quantities the animals chose to eat it; the amount, of course, being always accurately weighed, as also was that of the water taken. The oil-cake was broken small under an edge-stone. The linseed (excepting during the first few weeks, when some was found to be voided whole), the barley, and the malt, were also ground.

Below are given the average weekly consumption of food per sheep per week, and the periodical gain or loss of each animal throughout the course of the experiments:—

SERIES II.

TABLE 2.—Showing the Average Weekly Consumption of Food per Sheep in each Pen, the pounds Weekly Gain or Loss of each animal, the weekly average of each Pen, and the total gain of each animal throughout the period of the experiments.

Periods.			PEN 1. Average Food per Sheep per Week. Oil-cake, 7 lbs.; Clover Chaff, 22 lbs. 2 oz.						PEN 2. Average Food per Sheep per Week. Linseed, 7 lbs.; Clover Chaff, 20 lbs.					
From	To	No. of Days.	Sheep Numbers.					Weekly average gain or loss per Sheep.	Sheep Numbers.					Weekly average gain or loss per Sheep.
			1.	2.	3.	4.	5.		1.	2.	3.	4.	5.	
June 5	June 13	8	−11	1	−9	−1	8	−2·1	−6	−4	1	−9	4	−2·5
13	20	7	8	3	7	5	2	5·0	1	10	9	14	2	7·2
20	27	7	11½	4	6	1½	4½	5·5	3½	5	4	5	4½	4·4
27	July 4	7	0	2	2	3½	3½	2·2	1½	0	3	−1	−2	0·3
July 4	11	7	−½	1	1	2	−2½	0·2	−1	½	−4	1	1½	−0·4
11	18	7	3	1½	5	3	..	3·1	5	1½	4	−1	4	2 7
18	25	7	0	0	2	−1	−6	−1·0	−3	0	3	4	−2	0·4
25	Aug. 1	7	−2½	−½	4	−3	½	0·3	5½	0	5	2	4	3·3
Aug. 1	8	7	5½	4	−2	6	8	4·3	1½	4½	4	1	4	3·0
8	15	7	5	4	7	4	½	4·1	−2	½	2	1	−1	0·1
15	22	7	0	2	2½	1	4	1·9	0	−½	0	2	2	0·7
22	29	7	3	2	−½	−1	0	0·7	5	½	2	1	1½	2·0
29	Sept. 5	7	0	0	−2	2	0	0·0	3	4	7	4	2½	4·1
Sept. 5	12	7	−2	1	−1	0	1	−0·2	0	0	1	1	1	0·6
12	19	7	5	3	8	4	6	5·2	1	2	0	2	3	1·6
19	26	7	½	−3	−3	−1½	−1	−1·6	−2	2	2	0	−1	0·2
26	Oct. 3	7	3½	7	5½	2½	3	4·3	3	−½	1	1	1	1·1
Oct. 3	10	7	−2	−2	−1½	2	−1	−0·9	0	2½	2	1	5	2·1
10	17	7	0	3	1	1	0	1·0	0	−5	−2	−1	−2	−2·0
		Total	27	33	32	30	30½		16	23	44	28	32	

Periods.			PEN 3. Average Food per Sheep per Week. Barley, 7 lbs.; Clover Chaff, 20 lbs. 14 oz.						PEN 4. Average Food per Sheep per Week. Malt, 6 lbs. 9 oz.; Clover Chaff, 20 lbs. 12 oz.					
From	To	No. of Days.	Sheep Numbers.					Weekly average gain or loss per Sheep.	Sheep Numbers.					Weekly average gain or loss per Sheep.
			1.	2.	3.	4.	5.		1.	2.	3.	4.	5.	
June 5	June 13	8	−8	−1	8	4	−4	−0·2	−1	−4	−1	1	2	−0·5
13	20	7	14	4	6	3	9	7·2	8	13	8	1	2	6·4
20	27	7	2½	1	−1	5	3	2·1	0	0	2	4	4	2·0
27	July 4	7	1½	2	1	0	−3	0·3	4	0	0	−1	2	1·0
July 4	11	7	1	2	3	1	2	1·8	4	1	1	5	2	2·6
11	18	7	6	−1	2	3½	4	2·9	−1	2	2	−1	0	0·4
18	25	7	−1	1	−1	2½	1	0·5	−2	1	½	−1	2	0·1
25	Aug. 1	7	−2	−1	−1	1	1	−0·4	4	1	1½	½	1½	1·7
Aug. 1	8	7	2	3	2	4	4	3·0	½	4	4	1½	1	2·1
8	15	7	4	−2	2	0	−½	0·7	4	−2	0	0	3½	1·1
15	22	7	0	3	3½	4	3½	2·8	2½	3	2	3½	5	3·2
22	29	7	−1	1	−½	−4	−1	−1·1	−2	−1	−2	½	−3	−1·5
29	Sept. 5	7	5	3	4	3	6	4·2	5	5	5	5	4	4·8
Sept. 5	12	7	1	−3	−3	−2	−4	−2·2	−2	−½	−4	−½	2	0·6
12	19	7	−1	3	5	7	5	3·8	3	2	4	1½	2	2·5
19	26	7	5	0	−2	−1	−½	0·3	−1½	1½	−1½	2	−1	−0·1
26	Oct. 3	7	2	3	2	6	5½	3 7	½	−3	1½	2	5	1·2
Oct. 3	10	7	0	−1	−1	0	−1	−0·2	−1	1	0	0	−2	−0·4
10	17	7	−3	0	0	−1	−1	−0·8	−2	−2	−2	0	−1	−1·4
		Total	28	17	29	36	29		23	22	21	24	31	

When the sheep were put up it was intended to allow them a week in their new situation and upon their new food before commencing the experiments, they having been fed upon green clover in the field; but as almost every animal lost, and some very considerably, during the first 8 days, and then gained within a week or two very large amounts, it was thought that the average results would be overstated if the first week were not taken into account. This is accordingly done; and as the clover-chaff was not weighed during the first eight days, it is supposed to have been taken at the same rate as the mean of all the other periods. With this exception, and the replacement of No. 5 sheep in Pen 1 by a fresh one, as already noticed, the results of the Table are exactly as obtained by experiment. On inspection of the Table it will be seen that there is not a single animal which does not indicate a loss of weight at some, generally several periods of the experiment; whilst at others there is frequently during one week, or for several weeks together, an increase far above the average. Indeed such is the apparent generality of this fluctuation, which was so prominent also in the case of the first series, that the plan frequently adopted of deciding upon the quality of different foods by putting animals for a week or two on one, and then a week or two on another, and comparing the results, would seem on this account alone to be sufficiently condemned.

The average weekly gain or loss placed side by side will show how far there is any uniformity as to fluctuation throughout the several pens at the different periods of weighing.

SERIES II.

Table 3.—Showing the Weekly Average Gain or Loss per Sheep in each Pen throughout the course of the experiment.

	PERIODS.		Weekly Average Gain or Loss per Sheep in pounds and tenths.			
	From	To	**Pen 1.** Oil-cake and Clover.	**Pen 2.** Linseed and Clover.	**Pen 3.** Barley and Clover.	**Pen 4.** Malt and Clover.
1	June 5	June 13	−2·1	−2·5	−0·2	−0·5
2	13	20	5·0	7·2	7·2	6·4
3	20	27	5·5	4·4	2·1	2·0
4	27	July 4	2·2	0·3	0·3	1·0
5	July 4	11	0·2	−0·4	1·8	2·6
6	11	18	3·1	2·7	2·9	0·4
7	18	25	−1·0	0·4	0·5	0·1
8	25	Aug. 1	0·3	3·3	−0·4	1·7
9	Aug. 1	8	4·3	3·0	3·0	2·1
10	8	15	4·1	0·1	0·7	1·1
11	15	22	1·9	0·7	2·8	3·2
12	22	29	0·7	2·0	−1·1	−1·5
13	29	Sept. 5	0·0	4·1	4·2	4·8
14	Sept. 5	12	−0·2	0·6	−2·2	0·6
15	12	19	5·2	1·6	3·8	2·5
16	19	26	−1·6	0·2	0·3	−0·1
17	26	Oct. 3	4·3	1·1	3·7	1·2
18	Oct. 3	10	−0·9	2·1	−0·2	−0·4
19	10	17	1·0	−2·0	−0·8	−1·4

It can scarcely be said that there is more than a general coincidence as to tendency to greater or less gain or loss at the different periods, as shown in this summary. Some coincidence, however, there certainly is, for we find that at almost every period three if not four pens will bear the same general character as to gain or loss at the same time; and that, if any figure which is discrepant, be not explained on reference to the table of detail, by the evidently casual or unhealthy state of a single animal, a change to the opposite character immediately succeeds. There is at any rate a sufficiency of regularity to show that its cause is connected with a condition of the animal, apart from the casual irregularities in their management and the supply of their food, which a closer observation in relation to the health of the animal, and to the external circumstances affecting it, may serve to explain. Whatever be the cause of the fluctuation, however, the fact of it should be kept constantly in view by the experimenter, in order that erroneous conclusions founded upon temporary or accidental indications may be avoided.

In the following table are shown the average weekly consumption of food, and increase of each animal, throughout the entire period of nineteen weeks:—

SERIES II.

TABLE 4.—Showing the Average Weekly Consumption of Food per Sheep, and the Average Weekly Increase of each Animal in pounds and ounces.

Pen Nos.	Average Pounds Weight of Sheep at commencement.	Description and Quantity of Food per Sheep per Week.	Sheep Numbers.					Average Weekly Increase per Sheep in each Pen during the entire period of the experiment.	Average Weekly Increase per Sheep in each Pen during the first 11 Weeks of the experiment.
		lbs. oz.	1	2	3	4	5		
1	121½	Oil Cake . 7 0 Clover Chaff 22 2	1 6¾	1 11¾	1 11	1 9½	1 9½	1 9½	1 15½
2	121½	Linseed . . 7 0 Clover Chaff 20 0	0 13½	1 3¼	2 5	1 7½	1 11	1 8	1 11¼
3	120½	Barley . . 7 0 Clover Chaff 20 14	1 7½	0 14¼	1 8½	1 14¼	1 8½	1 7½	1 14
4	120½	Malt . . . 6 9 Clover Chaff 20 12	1 3¼	1 2½	1 1½	1 4¼	1 10	1 4½	1 13

By this summary it is seen that the average weight of the animals in the first and second pens, having respectively oil-cake and linseed, were identical at the commencement of the experiment; that of those in Pens 3 and 4, upon barley and malt, is 1 lb. less than that of the first two pens, but is identical in the two pens, the foods of which are supposed to compare with each other. The amounts of oilcake in Pen 1, and of linseed in Pen 2, are seen also to be identical. In the case of the pens upon barley and malt respectively, owing, as before stated, to the sheep on the latter not taking all that was provided for them at the commencement of the experiment, the average weekly consumption of malt is rather less than it was intended it should be, and by so much less than that of barley. We shall see further on, however, that this circumstance brings the experiments in some respects more nearly to the conditions required for exact comparison of the relative feeding values of the two substances than had the designed amount been eaten; for, though the actual weight of malt was less than that of barley, the amounts of *dry-organic-matter* consumed in the two cases are almost identical, and the quantity of malt actually taken moreover exceeded to a small extent that which would have been yielded by the amount of barley, with which its effects have to be compared.

It will be remembered, that in the first series of experiments there was so serious a variation in the degree of progress of the different animals on the same food, that the results were considered to be quite unfit to be taken as representing as they stood the comparative values of the several foods. This variation was specially remarkable in the pen upon oil-cake, and considerably with that upon oats, and it was attributed to a faulty matching of the animals; and it was suggested also that any defective vigour of constitution might probably be more likely prominently to show itself in disease upon the higher foods, such as oil-cake, than upon others. Be this as it may, Table 4, just given, shows a great improvement in this respect, and especially in Pen 1, in which again oil-cake is the *special* food, the uniformity is quite as good as could be at all anticipated. In Pen 2, with linseed, there is much less regularity than in Pen 1, there being one sheep giving an increase low compared with the rest, and another giving one as much higher; the two giving a mean so near to that of the other three, however, that the average of the entire pen may probably be taken as not far from a fair measure of the effect of this food as compared with the others. Although the general uniformity within each pen in this entire series is such as to give some confidence in the results compared one with another, yet the average weekly increase is throughout considerably less than in the case of the former series, notwithstanding that the animals were somewhat heavier to begin with, that the temperature of the period was considerably higher, and the amounts consumed of some of the more important constituents of food were greater. This may be supposed to be due to the fact of confinement within doors being less appropriate during the summer period, and perhaps indeed not attended with benefit as in the colder one, in part to the want of green food, which is so much relished during the summer season, and also in part to a rather long continuance of the same food, for in the last column of the Table in which is given the average weekly gain at an earlier period of the experiment, we see that it exceeds that calculated on the entire period. That the confinement and want of green food were not without effect is rendered probable from the fact that the remainder of the flock from which the experimental sheep were taken, and which were allowed the run of 40 acres of very highly manured clover, and about 1 lb. each per day of oil-cake besides, gave during eleven weeks about double the average weekly increase of those in the experimental pens, as the particulars given below of those whose marks remained legible will show.

TABLE.—Showing the Mean Weekly Increase of 30 Sheep, fed upon Green Clover, and 1 lb. each per day of Oil-cake, during a period of 11 Weeks.

Sheep Numbers.	Weight June 5.	Weight in lbs. August 21.	Pounds increase in 11 weeks.	Average Weekly Increase.
				lbs. tenths, &c.
1	117	161	44	4·00
2	103	133	30	2·73
3	112	147	35	3·18
4	108	148	40	3·64
5	101	134	33	3·00
6	106	143	37	3·36
7	100	131	31	2·82
8	123	161	38	3·45
9	115	155	40	3·64
10	98½	142	43½	4·00
11	113	145	32	2·91
12	126	157	31	2·82
13	111	145	34	3·09
14	117	158	41	3·73
15	113	145	32	2·91
16	129	162	33	3·00
17	116	154	38	3·45
18	109	149	40	3·64
19	114	145	31	2·82
20	111	142	31	2·82
21	103	138	35	3·18
22	110	146	36	3·27
23	107	145	38	3·45
24	116	146	30	2·73
25	101	144	43	3·91
26	97	131	34	3·09
27	115	158	43	3·91
28	101	140	39	3·54
29	109	143	34	3·09
30	116	152	36	3·27
	3,317½	4,300	1,072	3·28mean

The rate of increase here indicated falls little short of the wider estimates usually formed on this subject; and, whilst we are satisfied of the correctness of the figures given above, and do not doubt the statements of others, yet we are convinced that such results are very mischievously misapplied, if it be concluded that they in any degree fairly represent the average increase obtained in practical farming. Indeed the circumstances under which these sheep were placed were in every respect the most favourable that could be imagined, viz. summer weather and the feed of a luxuriant crop of highly manured clover, with oil-cake besides—conditions which at best can be equalled during a few months only of every twelve.

We now turn to a consideration of the composition of the food consumed in the experimental pens:—

SERIES II.

TABLE 5.—Showing the per Centages of Dry Matter, Mineral Matter, and Nitrogen in the Foods.

Description of Food.	Period of Consumption.		Date of Sampling.	Weight taken for Drying, &c.	Per Centages.					
					Dry Matter.		Ash.		Nitrogen.	
	From	To			Inclusive of Ash.	Organic only.	In fresh matter.	In dry matter.	In fresh matter.	In dry matter.
Oil-cake . .	June 5	Oct. 17	Sept. 12	2 Samples, 25 oz. each	87·36	81·88	5·48	6·27	5·01	5·74
Linseed, No. 1.	June 5	Aug. 23	Sept. 12	12½ oz. „	90·56	86·28	4·28	4·72	3·68	4·07
Linseed, No. 2.	Aug. 23	Oct. 17	Sept. 12	25 oz. „	91·54	87·46	4·08	4·45	4·05	4·44
Barley . . .	June 5	Oct. 17	Sept. 12	25 oz. „	85·54	83·23	2·31	2·70	1·49	1·74
Malt . . .	June 5	Oct. 17	Sept. 12	25 oz. „	91·65	89·34	2·31	2·52	1·51	1·65
Clover Chaff .	June 5	Oct. 17	Sept. 16	50 oz. „	84·66	77·39	7·27	8·58	2·11	2·50

From these analytical results it appears that weight for weight the oil-cake contained about 5 per cent. less dry-organic-matter than the linseed; the former has, however, about one-third more mineral matter, and nearly one-third more nitrogen than the latter. We believe that such may be taken, as representing, in general terms, the usual comparative composition of the two substances, as respects the constituents here named. We see, however, that one of the specimens of linseed contained 0·37 per cent. less nitrogen than the other, and it must be understood that different samples of both oil-cake and linseed are found to vary considerably from those referred to, and that the remarks made above are only intended to indicate a general fact, and do not at all do away with the desirableness of deciding upon the purchase of foreign food or manure, only upon the results of special analyses, for the ready provision of which the Royal Agricultural Society has recently made arrangement open to all its members.

The barley used in the experiments as such, and that which was malted, were both of the same stock and quality; the weight of the malt produced was, *exclusive of screened and kiln-dust*, only about four-fifths of that of the barley operated upon, so that as the weekly allowance of barley was 7 lbs. per sheep, that of malt would have been little more than 5½ lbs., instead of 6 lbs. 9 oz., as were actually consumed, if so much only were to be given as was the produce of the amount of barley with which it was to compare. Nearly one-half of the loss of weight sustained in the conversion of the barley into malt was, however, only water, and a portion of the remainder consisted of the "*dust*," which, if malting were adopted to any extent for feeding purposes, would certainly not be separated from the malt; and this, as we shall afterwards see in discussing other experiments with barley and malt, is a point of some importance. *Weight for weight*, however, the malt is seen to be about 6 per cent. richer than the barley in dry-organic-matter, and to be equal to it in mineral matter and in nitrogen; and it will be found that the quantities consumed of the two foods were in fact almost identical, so far as above-named constituents are concerned.

The following Table brings to view the total amount of food consumed in the pens during the entire period of the experiment—the total *increase* produced, and the amount of some of the more important constituents contained in the food, these being calculated from the Table of Analyses last given.

SERIES II.

TABLE 6.—Showing the Total Amount of Food or Constituents consumed, and of Increase produced, in each Pen, during the entire period of 19 Weeks.

	Total Increase in Live Weight.	Descriptions and Quantities of the different Foods consumed.	Total Dry Organic Matter consumed.	Total Mineral Matter consumed.	Total Nitrogen consumed.	Nitrogen in Increase of Animals, at 3 per cent.	Nitrogen in Increase, at 3 per cent. to 100 consumed.
	lbs.		lbs.	lbs.	lbs.	lbs.	lbs.
Pen 1. 5 Sheep.	152½	Oil-cake, 665 lbs. . . .	544½	36½	33·31	4·6	5·92
		Clover Chaff, 2,102½ lbs. .	1,627	152¾	44·36		
		Total . .	2,171½	189¼	77·67		
Pen 2. 5 Sheep.	143	Linseed, 665 lbs. . . .	577	27¾	25·50	4·3	6·55
		Clover Chaff, 1,903½ lbs. .	1,473	138¼	40·16		
		Total . .	2,050	166	65·66		
Pen 3. 5 Sheep.	139	Barley, 665 lbs. . . .	553½	15½	9·90	4·2	8·11
		Clover Chaff, 1,986¼ lbs. .	1,537	144¼	41·90		
		Total . .	2,090½	159¾	51·80		
Pen 4. 5 Sheep.	121	Malt, 625 lbs.	558½	14½	9·43	3·6	7·05
		Clover Chaff, 1,973¼ lbs..	1,527	143¼	41·63		
		Total . .	2,085½	157¾	51·06		

Taking the aggregate results of this Table, and again assuming the approximate correctness of the estimate of the nitrogen contained in the increase of animal produced, we find that by the feeding of 20 sheep for 19 weeks, during which time they consumed 665 lbs. of oil-cake, 665 lbs. of linseed, 665 lbs. of barley, 625 lbs. of malt, and 7965½ lbs. of clover-hay, the amount of increase obtained is calculated to retain only 16¾ lbs. of nitrogen, though 246 lbs. of it were supplied in the food, a result in this respect considerably inferior to that obtained in the first series of experiments, there being in that case 15¼ lbs. of nitrogen retained for 96 lbs. of it swallowed. We may notice too in this place, though the point will presently be referred to in another form, that here again it would appear, as in the case of the former series, that the larger the amount of nitrogen consumed beyond a certain limit, the smaller will be the *proportion of it* sent to market as meat. The case of the malt in the 2nd Series is, however, somewhat exceptional—a fact to which we shall again refer.

The amounts of *dry-organic-matter* consumed in each pen during the entire period of the experiment, as shown in the Table, when considered in connection with the nature of that contained in each of the special foods supplied, and with the total amount of nitrogen consumed, are such as pretty clearly to indicate that the consumption of the clover-hay, which was supplied *ad libitum*, was regulated to a great extent by the demand of the system for, or its competency to take up, digestible *non*-nitrogenous substances. Thus there were 544½ lbs. of dry organic substance contained in the oil-cake, and 577 lbs. in the linseed, whilst of the smaller amount taken in the oil-cake there would be a much larger quantity indigestible and at once effete, and hence we find that more clover is consumed to make up the deficiency. Again, taking the pens upon barley and malt, we find the total amount of dry-organic-matter in these foods respectively to be 553½ and 558½ lbs.—a difference of only 5 lbs.; and although in the one case there would be a predominance of starch, and in the other of sugar, yet the amounts of matters capable of digestion, and of those which are at once effete, would probably be very nearly identical, and hence we have a difference of only 10 lbs. in the total amount of dry-organic-matter consumed in the form of clover-hay: and, taking the two foods of each pen together, there is only a difference of 5 lbs., equal to only ¼ per cent. in the amount of dry-organic-matter consumed in the two cases. Throughout all four of the pens, indeed, the coincidence in that respect is very manifest, when the apparently excessive amount in Pen 1 is explained as above.

That the demand of the system for *nitrogen* had little to do in determining the amount of clover consumed, is evident from the fact, that, with the striking coincidences above noticed in the amounts consumed of *non*-nitrogenous substances available as food, the total amounts of nitrogen taken were—in the first pen, 77½ lbs.; in the second, 65½ lbs.; in the third, 51¾ lbs.; and in the fourth, 51 lbs. It is true that the nitrogen and dry-organic-matter are both nearly identical in Pens 3 and 4, but the nitrogen of these differs much from that of either of the other two pens, which again are widely different from each other—the variation in amount in the four pens being as three to two. These indications are interesting as pointing to the fact, that although nitrogen is a very important constituent in the food of animals, yet the economy of providing it in food, in quantity beyond a certain limit, must depend upon other circumstances than the amount of meat produced.

These points will be further illustrated by a consideration of Tables 7 and 8, which follow, in which the actual results of experiment as given in Table 6 are applied so as to show the average weekly consumption of food in each pen, by each 100 lbs. of live weight of animal, and also the amounts which were required to produce 100 lbs. of *increase.*

It should be observed in reference to these Tables, that the increase during the entire period of 19 weeks is taken as the basis of calculation. It will be remembered, however, that the average weekly increase at the end of the first 11 weeks, as given in Table 4, was more favourable throughout the pens than that after a further continuance of the experiment. This was particularly the case with respect to the pen on malt, and on reference to the details it will be found that several of the animals on that food gained scarcely anything whatever during the last eight weeks, though even at the earlier period the result was still rather in favour of the barley as compared with the malt. It is evident, therefore, that the indications, especially of Table 8, are less favourable throughout than they would have been had the experiment been earlier closed, and that the results of the malt pen are more affected than the rest. In vindication of the fairness of the comparisons shown in the Tables it may be said, that the results were less likely to be vitiated by accidental fluctuations or irregularities, if taken on the longer than on the shorter period, and that 19 weeks is not longer than animals are frequently kept upon the same food when fattening for the market. On the other hand, it may be urged, in reference to the malt, that, in practice, it would not be continued so long without change or further mixture with other food; and indeed, it would seem probable that, however genial to the health and tastes of the animals malt may be when employed only to a limited extent, yet after a time it loses its beneficial effects, probably nauseating

SERIES II.

TABLE 7.—Showing the Weekly Consumption of Food, or Constituents, by each 100 lbs. live weight of Animal.

	Description of Special Food.	Fresh Food consumed.			Dry-Organic-Matter consumed			Mineral Matter consumed			Nitrogen consumed		
		Special Food.	Clover Chaff.	Total Food.	In Special Food.	In Clover Chaff.	In Total Food.	In Special Food.	In Clover Chaff.	In Total Food.	In Special Food.	In Clover Chaff.	In Total Food.
Pen 1	Oil-cake	5·12	16·18	21·30	4·19	12·52	16·71	0·28	1·17	1·45	0·26	0·34	0·60
Pen 2	Linseed	5·14	14·76	19·90	4·45	11·42	15·87	0·21	1·07	1·28	0·20	0·31	0·51
Pen 3	Barley	5·21	15·56	20·77	4·33	12 04	16·37	0·12	1·13	1·25	0·08	0·33	0·41
Pen 4	Malt	4·95	15·67	20·62	4·42	12·12	16·54	0·11	1·13	1·24	0·07	0·33	0·40
Mean of the Four Pens		5·10	15·54	20·64	4·34	12·02	16·36	0·18	1·12	1·30	0·15	0·32	0·47

TABLE 8.—Showing the Consumption of Food, or Constituents, to produce 100 lbs. *increase* in live weight of Animal.

	Description of Special Food.	Fresh Food consumed.			Dry-Organic-Matter consumed			Mineral Matter consumed			Nitrogen consumed		
		Special Food.	Clover Chaff.	Total Food.	In Special Food.	In Clover Chaff.	In Total Food.	In Special Food.	In Clover Chaff.	In Total Food.	In Special Food.	In Clover Chaff.	In Total Food.
Pen 1	Oil-cake	436	1378	1814	357	1067	1424	23·89	100·18	124·07	21·84	29·08	50·92
Pen 2	Linseed	465	1331	1796	403½	1030	1433½	19·50	96·73	116·23	17·82	28·08	45·90
Pen 3	Barley	478½	1428¾	1907¼	398¼	1105¾	1504	11·06	103·84	114·90	7·12	30·11	37·26
Pen 4	Malt	516½	1630¾	2147¼	461½	1262	1723½	11·91	118·52	130·43	7·79	34·10	42·19
Mean of the Four Pens		474	1442	1916	405	1116	1521	16·59	104·81	121·10	15·61	30·42	44·06

to some extent by virtue of the large amount of sugar it contains.

From Table 7, we learn that the average quantities of dry-organic-matter consumed weekly to 100 lbs. live weight of animal, were, in Pens 1, 2, 3 and 4 respectively, in round numbers 16¾, 15¾, 16¼, and 16½ lbs.—amounts which, when the difference in the qualities of the food are considered, are probably very nearly identical, so far as the supply of the convertible *non*-nitrogenous organic substances is concerned. The mean of these is about 16¼ lbs., an amount which, as we shall see more in detail when the results of the several series of experiments are brought together, is about one-third more than was consumed in the case of Series I., notwithstanding that the mean temperature of the period of the latter was 40·6, and that of this 2nd series 58·4. The fact is, however, to be explained by a consideration of the character of the foods employed in the two cases. In Series I. swedes were the standard food, and in Series II. clover-hay, which, compared with the former, would contain a very large amount of inert woody fibre, and hence a much larger amount of gross dry organic substance was taken into the stomachs of the animals, to supply the same amount of that which would be subservient to maintaining the heat or promoting the increase of the body.

Looking, on the other hand, to the consumption of *nitrogen* in the several pens by a given weight of animal in a given time, we find here, as in the former series, a want of coincidence in this respect, the amount, as shown in the Table, being, in the first pen, 0·60; in the second, 0·51; in the third, 0·41; and in the fourth, 0·40 lb. It may be observed, however, that the *order* of *increase* in the pens is that of the assumption of nitrogen within a given time, though the *amount* of it is not in exact *proportion* to that of the nitrogenous supply. The average weekly consumption of nitrogen in this series is, however, more than half as much again as that in Series I., whilst the rate of increase in the former is less than that of the latter.

Thus, turning to Table 8, we see that, taking the mean of the four pens, there were 474 lbs. of the special foods and 1442 lbs. of clover-hay consumed to produce 100 lbs. increase in live weight, and that these together contained 1521 lbs. of dry-organic-matter and 44 lbs. of nitrogen, whilst there were in Series I. only 860 lbs. of the former and 19½ lbs. of the latter required to produce the same amount of increase—there being therefore nearly twice as much gross dry-organic-matter and more than twice as much nitrogen consumed in the one case as in the other, to produce the same effect; from which we learn that the circumstances of adaptation of the animal and of the food, as well as the actual composition of the latter, materially affect the amount of increase obtained.

Comparing the results of the several pens one with another, we find that the amounts of food consumed to produce the same effect were (excepting the case of the malt) such as to supply nearly identical amounts of gross dry-organic-matter; though, allowing for the varying amount of effete matter in the several substances, there would appear to have been notably less of such as would be really available as food, in proportion as the supply of nitrogen is greater. The amounts of nitrogen are seen to be less uniform than in several cases in the former series, yet here, as in the latter (excepting in the case of the malt), the increase is less in *proportion* to the nitrogen consumed, the larger the amount of the latter, though the *actual* increase is somewhat greater. Indeed, whether we view the results alone or conjointly with those which have gone before, it may safely be concluded that in all the pens in this second series the supply of nitrogenous compounds within a given time exceeded the limit that would have been required to yield the result obtained, provided the *non*-nitrogenous ones had been better adapted to the season, and to the natural inclinations of the animals at the time.

If we take the indications of the malt-pen as given in the Table, and calculated from the results of the entire period of the experiments, we see that there was a considerably larger amount of dry-organic-matter consumed in it, to produce a given effect, than in any of the other cases, and the amount of nitrogen moreover was considerably greater than in the case of the barley; and when it is considered that the dry-organic-matter of the malt would be nearly one-tenth less than that in the barley from which it was produced, the results tell still less favourably to the malt. If we were to make the calculations upon the results of the first eleven weeks, however, instead of the nineteen weeks as supposed above, the comparison would still, though to a small degree, be in favour of the barley, irrespectively of the cost of the malting process.

Relying upon the results of these experiments, it would appear that the increase obtained by the consumption of a given amount of *un*malted barley is considerably greater than would be produced by the same amount after it had been subjected to the malting process; and, indeed, that not only is the weight of the malt considerably less than that of the barley which yielded it, but that *weight for weight*, independently of loss and cost of process, the feeding qualities of the former are not superior to those of the latter. It would obviously be unsafe, however, to trust to the results of a single experiment; and since, in the one in question, dry food alone was given, the malt-dust was not employed, and the use of the malt seems to have been continued beyond the period of its best result, its indications may be open to some objection. To these points, however, we have paid particular attention in the conduct of further experiments on this subject, and the results will be detailed in the sequel.

In reference to the comparative effects of oilcake and linseed, we observe that a larger amount has been required of the latter than of the former, to produce the same gross increase in live weight, whilst in a given weight of the two, a larger amount of nitrogenous and of mineral matter would be brought upon the farm in the oilcake than in the linseed; the latter would, on the other hand, contain more of the *non*-nitrogenous organic substances. These points will be treated of more fully, however, when we come to consider the comparative composition of the manures obtained by the consumption of different descriptions of purchased or saleable food; and it will then be seen that a consideration of them will materially assist in deciding upon the economy of one food rather than another, when the results of the feeding-shed may be uncertain in their indications.

Reviewing the more general results of the second series of experiments, it is observed that there was upon the whole a greater regularity in each pen upon the same food than in the former one; yet, that such again is the evident fluctuation in the apparent progress of the animals, so far as it is exhibited by the scales, that it would appear necessary to admit its occurrence as a general fact, which, when the comparative value of foods is to be decided by the increase in weight of the animals fed upon it, should never be overlooked; and further, that such is the variableness in the amount of constituents consumed, and in the effects they produce, according to their appropriateness to the demands of the animal at the time, that not only may there be a larger amount of food expended within a given time, but that its product of meat will be defective in spite of a liberal supply of the more important constituents as shown by analysis, provided these be not in such state of combination and adaptation to each other as is suitable to the season of the year, and to the habits and tastes of the animals.

EXPERIMENTS WITH SHEEP.—*Series* III.

In the series of experiments last discussed, it was found that, although the amount of the highly nutritive nitrogenous compounds consumed by the animal was very large, yet the increase produced was far inferior to that obtained from a less amount of them in the case of the former series; and, the results now to be detailed will still further show, that the value of food depends materially upon other circumstances than the per-centage of these substances in them, though in the instances now before us the sources of insufficiency will be found to be opposite in their character to those already referred to.

The special object of this series was to trace the relative feeding and manuring values of turnips grown by different manures, by which, as we have shown in our paper on 'Turnip Culture' in this Journal, the composition of the produce, especially so far as the per-centage of nitrogen is concerned, may be materially influenced.

The turnips selected for the four pens were Norfolk-whites, grown in the season of 1848, in continuation of the experiments detailed in the paper above referred to. Those consumed in pen 1 were grown by mineral manures alone; those in pen 2 by the same manures, with sulphate and muriate of ammonia added; those in the 3rd, by the mineral manures, with rape-cake added; and in the 4th, with both rape-cake and ammoniacal salt, in addition to the mineral manures. These conditions, it will be remembered, are in *kind* the same as those supplied in the experiments of the season of 1845; the *quantities* have, however, been considerably varied, the amount of rape-cake being much increased, and that of ammoniacal salt diminished, by which, as will be explained on some future occasion, the progress of the plots relatively to each other has been somewhat altered.

In order that the amount of food consumed in each pen, and the effects produced, might fairly be taken to be attributable to the qualities of the different lots of turnips, and to their competency or insufficiency to supply the wants of the system, it was decided that the turnips should themselves constitute, almost exclusively, the supply of food to the animals. It was thought, however, that cut straw would interfere but little with the results in this respect, and that it would assist in providing the *bulk* of dry substance, which, independently of matters of more directly nutritive quality, seems to be essential to healthy digestion in ruminant animals more especially. It was found, however, that although both straw and turnips were finely cut and mixed together for some time before being given to the animals, the former was almost entirely refused, in consequence of which its use was abandoned after a sufficient trial, and the turnips were given alone. It could not be expected that the animals would do well upon such food, but as the composition of the turnips was supposed to vary very greatly, especially as regarded the per-centage of nitrogen, which is generally believed to determine, to a great extent, the value of produce for feeding purposes, it was thought, that whatever the results might be, they would not be without their lesson. It happened, indeed, that many of the animals lost weight, yet the results, thus negative in their character, are found to provide much useful information as to the conditions, other than those of mere per-centage composition, which are required to constitute a healthy food. Having reference, for the present, to this part of the subject more especially, and leaving the question of the manure produced for future notice, it will not be necessary to give the results in much detail, but only such a summary as will illustrate the point in question.

The animals taken were ewe lambs, bred upon the farm. About one hundred were weighed November 27, 1848, from which six were selected for each of the four pens. They were supplied with Norfolk-white turnips from the commencement, but the weighed quantities of those grown by the different manures were not commenced until December 9, up to which time there was a loss of weight in all the pens. The average weight of the animals was about 75 lbs.

The Table in the following page gives some insight into the composition and quality of the four lots of turnips.

In our former papers in this Journal we have called attention to the fact, that, notwithstanding it is well known that turnip-leaves are far inferior to the roots as food, yet they contain a much higher per-centage of nitrogenous compounds, which, *other things being equal*, are taken to indicate the feeding value of different articles of food; and we have suggested, that to the relatively low state of elaboration of the constituents of the leaves may be due their defective feeding properties, containing, as they do, a comparatively large amount of matters, "only brought within the range of the organism, themselves as yet unorganized, and existing as saline and other changeable fluids, to which we may readily attribute a medicinal and purgative rather than a direct nutritive effect— elaboration to some extent being, as we are aware, an important element in the condition of food for animals." We have further shown, too, that although the per-centage of nitrogenous compounds in the root may be much increased by the use of nitrogenous manures, yet when these are in excess, the tendency to the over-production of leaf will be much enhanced, whilst the root, though richer in nitrogen, may not be profitably developed; and the results now to be detailed will sufficiently prove, that the high per-centage of nitrogen in the root can no more than in the leaf be taken as unconditionally indicating its feeding value.

Referring to the Table of composition just given, and assuming that, other things being equal, a greater degree of ripeness or maturity of specimens of turnips—after an equal period of growth, and the produce of different manures—is indicated by a large amount of dry matter, a small amount of mineral matter and of nitrogen, and a small proportion of leaf to bulb—and, that a relatively small amount of dry matter, a large amount of mineral

SERIES III.

TABLE 1.—Showing the particulars of the Growth and Sampling of the several lots of Turnips consumed; their per centage contents of Dry Matter, of Mineral Matter and of Nitrogen, and the proportion of Leaf to Bulb when taken from the land.

	Particulars of Growth, Consumption, Sampling, &c., of the Turnips.					Per Centage Composition.						Quantity of Leaf to 1,000 of Bulb.
	Description of Turnip, and particulars of Growth.	Consumed.		Date and particulars of Sampling	Weight taken for Drying, &c.	Dry Matter.		Ash.		Nitrogen.		
		From	To		lbs. oz.	Inclusive of Ash.	Organic only.	In Fresh Substance.	In Dry Matter.	In Fresh Substance.	In Dry Matter.	
Pen 1	Norfolk White Turnips, grown by Mineral Manures only	Dec. 9	Feb. 16	1848. Nov. 8 direct from the field	54 7½	9·37	8·74	0·627	6·69	0·146	1·56	379
Pen 2	Ditto ditto ditto, grown by Mineral Manures and Ammoniacal Salts	Do.	Do.	Do.	61 1½	8·42	7·79	0·630	7·48	0·175	2·08	579
Pen 3	Ditto ditto ditto, grown by Mineral Manures and Rape Cake	Do.	Do.	Do.	73 12	7·78	7·14	0·639	8·21	0·183	2·36	612
Pen 4	Ditto ditto ditto, grown by Mineral Manures, Rape Cake, and Ammoniacal Salts	Do.	Do.	Do.	62 9	7·88	7·17	0·703	8.92	0·252	3·20	938

matter and of nitrogen, and a large proportion of leaf to bulb, betray, on the other hand, to a great extent, a less maturity of growth—we should at once decide, that of the four specimens of turnips, those consumed in pen 1 were the *ripest*, those in pen 2 coming next, then those in pen 3, and that those in the 4th pen were much below the others in this respect; for, we find the proportion of leaf to bulb, and the per-centages of mineral matter and nitrogen, are progressively greater as we proceed down the columns from the 1st pen to the 4th; whilst, with a trifling exception in the case of the turnips consumed in pen 4, the per-centage of dry-matter is in the inverse order. These inferences, indeed, accord perfectly with the judgment which was formed of the crops at the time they were drawn from the land, for the turnips grown by mineral manure alone had become somewhat '*pithy;*' those of pen 2, the produce of mineral manures and ammoniacal salts, were *fully ripe;* those of pen 3, from mineral manures and rape-cake, were scarcely so; whilst those of pen 4, having the mineral manures, and both rape-cake and ammoniacal salts in addition, were far behind the rest in fitness for consumption, and indeed they were considerably short of this point. If, however, the *per-centage of nitrogen* were to be our guide in deciding upon the feeding value of the several specimens, the crude turnips of pen 4 would far exceed the rest in this respect.

The results of the feeding experiments are arranged in the three following Tables (p. 311). In the first are given the actual quantities of fresh turnips, of dry-organic-matter, of mineral matter, and of nitrogen, consumed in each pen by six sheep during 68 days, and the increase or loss of weight of the animals; in the second is shown the weekly consumption of fresh food, and of the several constituents, to every 100 lbs. live weight of animal; and in the third, the amounts required to produce 100 lbs. increase in live weight.

In explanation of the construction of the first of these Tables, which supplies in fact, to a great extent, the materials for the other two, we should observe, that—in order to avoid the error to which it is supposed the determination of the quantity of swedes consumed in the first series of experiments was subject, and which was attributable to the constant loss of weight of roots after removal from the land—in the present instance, 5 tons of each of the lots of turnips were weighed as nearly direct from the field as was practicable, and from this stock smaller quantities were weighed out to the sheep as they were wanted. It was thus found that the sum of the weights taken during the course of the experiments, which ended about three months after the carting of the turnips, fell short of the original amount by 20½ per cent. in the turnips grown by mineral manures only, by 18 per cent. in those

SERIES III.

TABLE 2.—Showing the Total Increase or Loss of Weight, and the Total Consumption of Fresh Turnips, of Dry Organic Matter, of Mineral Matter, and of Nitrogen, by 6 Sheep in each Pen during 68 days; Quantities stated in lbs.

Pen.	Total Increase or Loss of Live Weight in 6 Sheep in 63 Days.	Description of Turnip and particulars of Growth.	DIVISION 1. Weights as taken during the course of the Experiment.				DIVISION 2. Quantities corrected by calculation to represent the Turnips as taken from the Field, sampled for analysis.				Nitrogen in Increase at 3 per Cent.	Nitrogen in Increase (at 3 per Cent.) to 100 consumed
			Fresh Turnips.	Dry Organic Matter.	Mineral Matter.	Nitrogen.	Fresh Turnips.	Dry Organic Matter.	Mineral Matter.	Nitrogen.		
1	28 lbs.	Norfolk White Turnip, grown by Mineral Manures only	5,827	509½	36½	8·50	7,328	640¾	46	10·69	0·84	7·9
2	45 ,,	Ditto, grown by Mineral Manures and Ammoniacal Salts	6,254	487¼	39½	10·94	7,626	594½	48	13·34	1·35	10·1
3	22 ,,	Ditto, grown by Mineral Manures and Rape Cake . .	6,181	441½	39½	11·31	7,306	521¾	46½	13·36	0·66	4·9
4	20 lbs. loss	Ditto, grown by do., Rape Cake, and Ammoniacal Salts	5,763	413½	40½	14·52	6,647	477	46¾	16·75		
			24,025	1,941¾	156	45·27	22,260	1,757	140¼	37·39	2·85	7·6

TABLE 3.—Showing the Weekly Consumption of Fresh Turnips, of Dry Organic Matter, of Mineral Matter, and of Nitrogen to each 100 lbs. live Weight of Animal.

Pen.	Description of Turnip and particulars of Growth.	DIVISION 1.—Weights, &c.				DIVISION 2.—Quantities, &c.			
		Fresh Turnips.	Dry Organic Matter.	Mineral Matter.	Nitrogen.	Fresh Turnips.	Dry Organic Matter.	Mineral Matter.	Nitrogen.
1	Norfolk White Turnip, grown by Mineral Manures only . .	130½	11½	0·82	0·19	164	14⅓	1·03	0·24
2	Ditto, grown by Mineral Manures and Ammoniacal Salts . .	137½	10¾	0·87	0·24	167¾	13	1·06	0·29
3	Ditto, grown by Mineral Manures and Rape Cake	147	10½	0·94	0·26	173¾	12½	1·11	0·31
4	Ditto, grown by ditto, Rape Cake, and Ammoniacal Salts . .	135½	9¾	0·95	0·34	156¼	11¼	1·09	0·39
	Mean . . .	137½	10½	0·89	0·25	165½	12¾	1·07	0·31

TABLE 4.—Showing the Consumption of Fresh Turnips, of Dry Organic Matter, of Mineral Matter, and of Nitrogen to produce 100 lbs. increase in Live Weight.

Pen.	Description of Turnip and particulars of Growth.	DIVISION 1.—Weights, &c.				DIVISION 2.—Quantities, &c.			
		Fresh Turnips.	Dry Organic Matter.	Mineral Matter.	Nitrogen.	Fresh Turnips.	Dry Organic Matter.	Mineral Matter.	Nitrogen.
1	Norfolk White Turnip, grown by Mineral Manures only . .	20,810¾	1,819½	130½	30½	26,171	2,288¼	164	39
2	Ditto, grown by Mineral Manures and Ammoniacal Salts . .	13,897¾	1,082½	87½	24¼	16,946	1,321¼	106¾	29½
3	Ditto, grown by Mineral Manures and Rape Cake	28,095½	2,006¼	179½	51½	33,209	2,371¼	212¼	60¾

grown by mineral manures and ammoniacal salts, by 15½ per cent. in those having rape-cake as well as the mineral manures, and by 13⅓ per cent. in those having both ammoniacal salts and rape-cake in addition to the mineral manures. It is evident therefore, that the weights of the turnips, as they were given to the sheep, by no means indicated the amount of such as originally came to the shed; and it will readily be understood that the error from this cause in the estimate of the swedes consumed in the case of the first series of experiments, might easily amount to one-sixth, or more, of the whole quantity supplied, as has been already assumed.

The figures in the four columns constituting the first divisions of the Tables, show the quantities of food or constituents consumed, supposing the weights taken during the course of the experiments to denote the quantities of turnips provided in the state in which they were brought from the field; and those in the second divisions are obtained by calculating from the per-centage of loss as given above, to what amount of turnips, in their original state, those left at the end of the experiment would be equivalent —deducting this amount from the 5 tons brought to the shed, and calculating what proportion of the remainder was consumed, and what was offal, according to the relative weights of these, as ascertained as the experiment proceeded.

A glance at the Tables will show that the estimate of the constituents consumed would have been very far below the truth, if the analysis of the turnips as carted from the field, and the weights as given to the animals from time to time, were taken as the basis of calculation. It is obvious, however, that although the figures of the second division are much nearer the truth than those of the first, yet they may probably slightly overstate the facts; for the per-centage of loss, or waste, would certainly be somewhat higher upon the turnips which remained to the end of the experiment than upon those which had been weighed at an earlier period, from the amounts of which the per-centages as given above are calculated. The discrepancy would not be great, however, since the actual amount remaining at the conclusion formed but a small proportion of the entire bulk, there having been a considerable quantity thrown away as offal throughout the period, part of this being what the animals left in their troughs, but the greater portion those which were rotten, of which there were more than twice as many in the turnips of the 4th than in those in any of the other pens, there being least in pens 1 and 2.

These statements are only brought forward to illustrate the fact that a considerable change of some kind or other takes place in succulent food after it is stored, and to show that the estimate of the quantity of constituents consumed to produce a given amount of meat or manure, is subject to a wide range of miscalculation, unless special care be taken to avoid it. For our present purpose we shall assume the figures in the second division of the several Tables to be correct, though, as will be seen when we come to the question of the *manure produced,* some further corrections may require to be made, which, however, are unimportant just now.

Looking to Table 2, and excluding the results of the 4th pen, wherein all the animals lost weight, we find that upon this insufficient diet of turnips only, there were of them 22,260 lbs., or about 10 tons, containing 1757 lbs. of dry organic matter, 140½ lbs. of mineral matter, and 37½ lbs. of nitrogen, consumed to produce 95 lbs. increase in live weight, which may be estimated to contain about 3 lbs. of nitrogen. This result, as far as regards the consumption of and produce by nitrogen, is as favourable as that of the second series, wherein the amount of dry substance in the food consumed was in excess rather than in defect, as in the present instance: they are, however, less favourable than that of series 1.

Turning to Table 3, we see that the average weekly consumption to 100 lbs. live weight of animal was about 1½ cwt., there being, however, a smaller quantity consumed in pen 4, the roots in that case being more unripe than in any of the other pens. The comparisons will, however, he brought more clearly to view in the column of dry-organic-matter consumed.

Thus we have to each 100 lbs. live weight, 14⅓ lbs. in pen 1, 13 lbs. in pen 2, 12½ in pen 3, and only 11½ lbs. in pen 4, of dry-organic-matter consumed weekly; and when we take into consideration the comparative qualities of the several lots of turnips, the relation of these quantities to each other would seem to be just such as might have been anticipated, and to offer further indication of the fact, that *consumption,* to a great extent, is regulated by a demand for available non-nitrogenous organic constituents of food. The highest amount of dry-organic-matter consumed was in pen 1, where the turnips were too far grown, and such as are usually termed pithy; and it is probable, therefore, that the amount of matters strictly applicable as food to the animal was less than in pen 2, where the roots were less fully grown. In pen 3 there is a less amount of dry-organic-matter consumed than in the former ones, though it will be seen that the quantity of fresh roots was larger in this than in any of the other cases; and it is probable that, independently of the defective nutritive quality of these turnips arising from their lower state of maturity, the large amount of water necessarily swallowed with the food, would put some check upon the quantity eaten, and thereby prevent the supply to the animals of as much as would provide the amount required for their health and increase, of the fully elaborated substances. In pen 4 there was much less dry-organic-matter consumed than in any of the rest, whilst it would appear that the limit of consumption was here less regulated by the amount of water taken with the food than by the composition of the solid substance itself, which was known to be not matured, and seems to have been quite unfit for food, since all the animals lost weight, *notwithstanding that the weekly consumption of nitrogenous compounds was considerably greater than in any of the other cases;* indeed, in pen 2, with a gain in weight of 45 lbs., there was only 0·29 lbs. consumed per week, whilst in pen 4 there was a loss of 20 lbs., with a consumption per sheep per week of 0·39 lbs. of nitrogen—an amount as great as that provided in the pen with oil-cake and swedes in the first series of experiments!

Here then we have a striking illustration of the fact, that, however important the ultimate composition of food may be, its state of combination may materially affect its value. Indeed it is seen that double the requisite amount of some of the more important constituents of food may be expended upon the animal without any benefit whatever; and with these facts before us in reference to the turnip *bulb* in different stages of growth and maturity, it can scarcely be wondered at that the *leaves*, notwithstanding their high per centage of nitrogen, should be comparatively valueless as food; nor can it be doubted that the want of nutritive quality is due, as we have before observed, to the amount they contain of unorganized or deficiently elaborated constituents.

The variableness in the amount of ultimate constituents required to produce a given effect, according to their condition of combination and elaboration, is clearly seen in Table 4, in which are given the amounts of fresh turnips, of dry-organic-matter, of mineral matter, and of nitrogen, which were consumed in the several pens to the production of 100 lbs. increase in live weight, the results, of course, of pens 1, 2, and 3 only being open to this calculation. There is a difference in this respect, according to the composition of the turnips in the several cases, of about 7 tons of the fresh roots—there being about 7½ tons consumed in pen 2, about 11¾ tons in pen 1, and 14¾ tons in the 3rd, or nearly as many more as in the first. It is worthy of remark, too, that in pen 2, the turnips of which were taken at the best stage of growth, though their per centage of nitrogen was less than those of pen 3, there is not only a less amount both of dry-organic-matter and nitrogen consumed to produce a given amount of gross increase than in either of the other cases, but the quantity of these is less in this case, with common white turnips alone, than in any of the cases of the second series of experiments, in which, as will be remembered, there were given in one pen oil-cake and clover-chaff, in one linseed and clover-chaff, in another barley and clover-chaff, and in another malt and clover-chaff.

The prominent inference from the results of the second and third series of experiments—in the former of which it is supposed that there was probably an excess of *all* required constituents of food, and in the latter at least of *some*—is, that in neither were these in a favourable condition to meet the wants of the animals; and that if, as we believe to be the case, *other things being equal*, the amount of nitrogen in food greatly determines its value as such, there will be a very wasteful expenditure of it, unless the food employed be suited to the tastes and circumstances of the animals; and that if these points be not attended to, any calculation as to the probable amount of meat and manure respectively, produced by the consumption of a given amount of food, will be uncertain and unsatisfactory. Under any circumstances, however, the attainment of so desirable an end as bringing within the range of fixed rule and measurement the subtle, yet not capricious, operations of animal life, would seem, from the very nature of the subject, to be fraught with difficulty, as indeed the results of experiment are found to furnish ample testimony.

Experiments with Sheep.—*Series* IV.

It was intended by this series of experiments further to test the feeding and manuring value of barley and malt, compared both one with the other, and with other articles of food. It will be remembered that in the former experiments with these substances, the complementary food was clover-chaff; and, that the animals not making much progress, this was supposed to be due to the want of succulent food, which, however, could not at the time be employed.

The present series was commenced in February, 1849; and it was at first intended to have given Swedish turnips with the other foods, but it was feared that they would not remain in a good and sound condition so long as the experiment was required to be continued, and mangold-wurzel was therefore decided upon as better suited to our purpose in some respects, though in others not without objection; for although the mangolds would remain in a sufficient state of preservation to the end of the experiments, yet they are seldom a genial food so early in the season as it was required to use them, whilst sheep do not seem to relish them as they do the turnip; aud the results to be detailed will show that these circumstances were not without their influence.

A flock of 100 three-year old wethers, which had been recently fed in the field upon swedes and clover-chaff, were weighed February 26, from which, according to weight and general similarity of breed, 45 were taken, and 5 put into each of 9 of the experimental pens, it being so arranged, that, as far as possible, each sheep had its counterpart in weight and make in each of the other pens, though within each pen the animals might in both these respects show a somewhat wider difference. Six of these pens comprised the experiments now to be described, the other three constituting a series of themselves, of which we shall speak hereafter.

When first weighed, the sheep were very dirty, and it would have been desirable to have had them previously trimmed; but it was considered that they would compare with each other in this respect, and that as it was intended to allow them a week or more to get accustomed to the new food and situation before commencing the exact experiment, they would by that time have lost much of their adherent dirt, and that their second weights would be somewhat uniform. For some time, however, scarcely any of the animals did well upon their food, by no means a fair allowance of the mangolds being eaten. One or two of them, indeed, it was found necessary to kill; and most were in such a condition as to require that the commencement of the experiment should be postponed until the animals had been three weeks in the pens, during which time none had done well. Many had, besides the loss of dirt, apparently depreciated in actual live weight also; whilst the order within each pen, and the uniformity between one pen and another, were considerably deranged, as will be seen by an inspection of the following Table:—

SERIES IV.

TABLE 1.—Showing the Weight of each Sheep and each Pen on Feb. 26, when put up, and on March 20, when the experiment was commenced. Quantities stated in lbs.

No. of Sheep.	February 26, when put up.						March 20, when the experiment commenced.						April 17
	Pen 1	Pen 2	Pen 3	Pen 4	Pen 5	Pen 6	Pen 1	Pen 2	Pen 3	Pen 4	Pen 5	Pen 6	Pen 6
1	143	143	143	143	143	443	136	146	139	144	134	142	150
2	140	140	139	140	139	140	136	121	..	144	145	..	..
3	137	136	136	138	136	137	136	133	133	135	134	130	135
4	134	135	135	134	135	135	..	130	127	137	136	125	131
5	132	132	133	132	133	132	111	123	137	..	117	107	120
average	137,2	137,2	137,2	137,4	137,2	137,4	129	130	134	140	133	126	134

Taking the first division of the Table, it is seen that the average live weight was the same in all the pens when the animals were first put up, and that the weights of those bearing similar numbers in the different pens were also nearly identical. There is, however, a difference of about 10 lbs. between the heaviest and the lightest sheep in each pen. The second division shows that, on March 20, when the more exact experiment commenced, nearly every sheep had lost—some very considerably—and the uniformity between pen and pen, as well as between the sheep previously supposed to match with each other in the different pens, was also lost, so far as weight is concerned. In some cases the loss was probably chiefly dirt and moisture, though in some it was manifestly owing to an inaptitude of the food. This, however, can scarcely in any case be attributed to the *special* foods, but much more certainly to the mangolds, so that it would be unfair, in judging of the effects of the former, to calculate the result from the first weighing, though on the other hand a careful examination of the tables of increase which will be given, will show that several of the instances of rapid increase after the second weighing occur where the animals had previously lost considerably, so that the natural effect of the food during the actual experimental period is from this cause occasionally somewhat overstated. For, as we have already remarked, any considerable loss arising from causes of but temporary influence, is generally succeeded by an apparently excessive gain, and *vice versâ.* It is obvious that these irregularities must to some extent depreciate the absolute legitimacy of the numerical results; yet it is nevertheless thought that attention thus being called to any probable sources of objection to which the second weights are liable, they may be taken as the fairer starting-point in comparing the effects of the several *special* foods. These are, therefore, mainly relied upon, though the results, as calculated from the first weighing of the animals, will also be given, in order that the reader may form his own judgment in the matter.

The special foods selected were *barley*, *malt,* and *beans,* the latter chiefly as containing a much larger per-centage of nitrogen than the former. They were allotted to the several pens as under:—

Pen 1.—1 lb. of *ground* barley per sheep per day.

Pen 2.—Ground malt, with its dust (the produce of 1 lb. of barley), ditto.

Pen 3.—1 lb. of barley, *ground* and *steeped,* ditto.

Pen 4.—Malt and dust from 1 lb. of barley, *ground* and *steeped,* ditto.

Pen 5.—1 lb. of malt and dust, *ground,* ditto.

Pen 6.—1 lb. of beans, *ground,* ditto.

The mangolds were supplied to all the pens in any quantity the animals chose to eat them. The beans were, from the commencement, scarcely touched; one of the animals fed upon them had soon to be removed and killed, and the rest, with the exception of a single sheep, lost so much as to bring the average weight down below that of any of the other pens—a result which is not easily accounted for by a consideration of the character of the food supplied. It was soon discontinued, however, and oil-cake and swedes, a few mangolds only being intermixed, were given to the animals until they were supposed somewhat to have regained their position, after which mangolds and oil-cake were given alone.

The collected results of the experiments are given in Table II.

An account of the progress of those animals which either died from illness, or were killed, is excluded from this Table; and it will be seen that there was one such in pen 1, with dry barley; one in pen 3, with steeped barley; one in pen 4, with steeped malt; and one in pen 6, with the beans. No. 1 sheep, in pen 3, also with dry malt, became unwell during the last few weeks of the experiment, and it was found necessary to kill him a few days after the experiment closed. As, however, his increase was fair at the commencement, and he actually lived to the end of the experiment, his weights are admitted into the calculations. This bad result, as to the health of the animals, is sufficiently general in the different pens to show that the explanation of it cannot be sought in the character of the *special* foods employed. It is indeed more probable that the mangolds, and perhaps not immaterially the confinement also, were at fault.

A glance at the *top* line of results in the Table will show how very general throughout the pens was the loss of weight during the first 22 days. In the *bottom* one is given the total gain of each animal, inclusive of this preliminary period. This estimate, however, is an under-statement of the effects of the special foods, since it is affected both by the amount of dirt and moisture lost, and by the depreciation due to the inaptitude of the succulent food employed. The results of the experimental period, on the other hand, being, as has been before observed, more probably in excess, depending chiefly on some few cases of individual irregularity. In some few instances, however, the somewhat excessive rates of gain of single animals, after the commencement of the experimental period, are seen not to have been preceded by a corresponding loss, and in such cases the results of the experimental period are not open to the objections referred to above.

The average weekly gain of the animals is given in Table III.

Looking *across* the columns of the Table, we see that whether we calculate from February 28, as in the first division, or from March 20, as in the second, the rates of increase of different sheep upon the same food are very variable, and so general is the irregularity in all the pens, that it cannot be determined that one food was less subject to it than another. The variations are, however, more prominent on the experimental than upon the longer period—a circumstance already explained.

So far as the average results can be relied upon as providing a

SERIES IV.

TABLE 2.—Showing the Weekly and the Total Increase of each Animal and Mean Weekly Increase in each Pen.

Periods.			Pen 1.						Pen 2.					
From	To	No. of Days.	Sheep Numbers.					Mean Weekly Increase per Sheep.	Sheep Numbers.					Mean Weekly Increase per Sheep.
			1.	2.	3.	4.	5.		1.	2.	3.	4.	5.	
Feb. 26	Mar. 20	22	−7	−4	−1		−21		3	−19	−3	−5	−9	
Mar. 20	April 3	14	3	−3	3		10	1·6	3	4	6	12	14	3·9
April 3	10	7	1	4	1		3	2·2	2	−2	−1	2	−4	−·6
10	17	7	4	5	8		1	4·5	..	7	5	2	8	4·4
17	May 1	14	3	2	−3		15	2·1	6	11	1	2	7	2·7
May 1	8	7	1	−1	..		..	·2	−3	−3	−1	3	..	−·8
8	15	7	3	8	4		7	5·5	1	2	2	1	4	2·0
15	22	7	4	..	..		−2	0·5	..	4	1	3	−1	1·4
22	29	7	−2	..	2		..	0·0	−1	..	4	..	4	1·4
Total increase during experimental period		70	17	15	15		34		8	23	17	25	32	
Total increase from time of putting up		92	10	11	14		13		11	4	14	20	23	

Periods.			Pen 3.						Pen 4.					
From	To	No. of Days.	Sheep Numbers.					Mean Weekly Increase per Sheep.	Sheep Numbers.					Mean Weekly Increase per Sheep.
			1.	2.	3.	4.	5.		1.	2.	3.	4.	5.	
Feb. 26	Mar. 20	22	−4		−3	−8	4		1	4	−3	3		
Mar. 20	April 3	14	7		3	2	..	1·5	−4	−2	−4	−2		1·5
April 3	10	7	−1		7	3	3	3·0	..	4	6	2		3·0
10	17	7	9		2	..	5	4·0	4	6	6	5		5·2
17	May 1	14	5		2	4	−3	1·0	12	3	11	7		4·1
May 1	8	7	9		−7	6½	5	3·3	3	1	2	4½		2·6
8	15	7	2		2	−1½	1	0·8	−1	½	3	4		1·6
15	22	7	2		4	4	1	2·8	1	−½	−1	½		0·0
22	29	7	7		6½	6	6	6·3	1	1	4	1		1·7
Total increase during experimental period		70	40		19½	24	18	2·2	16	13	27	22		
Total increase from time of putting up		92	36		16½	16	14		17	17	24	25		

Periods.			Pen 5.						Pen 6.					
From	To	No. of Days.	Sheep Numbers.					Mean Weekly Increase per Sheep.	Sheep Numbers.					Mean Weekly Increase per Sheep.
			1.	2.	3.	4.	5.		1.	2.	3.	4.	5.	
Feb. 26	Mar. 20	22	−9	6	−2	1	−16							
Mar. 20	April 3	14	6	1	4	6	12	2·9						
April 3	10	7	0	4	2	..	5	2·2						
10	17	7	1	4	5	4	7	4·2						
17	May 1	14	2	3	3	9	6	2·3	4		5	9	6	
May 1	8	7	2	1½	½	2½	..	1·3	..		2	1	−½	
8	15	7	4	3½	−4½	½	2	1·1	4		6	4	4½	
15	22	7	−2	0	4	1	8	2·2	−3		1	4	4	
22	29	7	3	−1	2	−4	1	0·2	3		7	3	9	
Total increase during experimental period		70	16	16	16	19	41		8		21	21	23	
Total increase from time of putting up		92	7	22	14	20	25							

SERIES IV.

Table 3.—Showing the Average Weekly Increase of each Sheep, and the Average Weekly Increase per Sheep in each Pen, from the time of putting up, and during the period of the experiment. Quantities stated in pounds and ounces.

Pen Nos.	Number of Sheep in each Pen.	Average Weight of Sheep in lbs.		Description and Quantities of Food consumed per Sheep per Week.	From 26th February, when put up, to 29th May.					From 20th March, when experiment commenced, to 29th May.					Average of each Pen.	
		Feb. 29, when put up.	March 20, when the experiment commenced.		Sheep No. 1.	Sheep No. 2.	Sheep No. 3.	Sheep No. 4.	Sheep No. 5.	Sheep No. 1.	Sheep No. 2.	Sheep No. 3.	Sheep No. 4.	Sheep No. 5.	From Feb. 29, when put up.	From March 20, when experiment commenced.
1	4	138	129¾	Barley, 7; Mangels, 96½	0 12¼	0 13½	1 1¼	..	1 0	1 11¼	1 8	1 8	..	3 6½	1 0¾	2 0½
2	5	137	130½	Malt, with its dust, 5⅔; Mangels, 106½ .	0 13½	0 4¾	1 1¼	1 8¾	1 12¼	0 12¾	2 4¾	1 11¼	2 8	3 3¼	1 1¾	2 1½
3	4	136¾	134	Barley, 7 (steeped); Mangels, 117½ . .	2 12¼	..	1 3¾	1 3½	1 11	4 0	..	1 15¼	2 6½	1 12¾	1 11½	2 8½
4	4	138¾	140	Malt, with its dust, 5⅔ (steeped); Mangels, 111½	1 4¾	1 4¾	1 13½	1 14½	..	1 9½	1 4¾	2 11¼	2 3¼	..	1 9½	1 15¼
5	5	137	133	Malt, with its dust, 7; Mangels, 108 .	0 8½	1 11	1 1¼	1 8¾	1 14½	1 9½	1 9½	1 9½	1 14½	4 1½	1 5½	2 2½
6	4	..	..	Oilcake, 6; Mangels, 109¾	1 2¼	..	1 7¼	1 4¾	0 13½	*1 5¼	..	*3 8	*3 8	*3 13¼	..	*3 0½

* Calculated from April 17, to May 29, 1849.

measure of the comparative effects of the different foods, it appears, taking either period, that the *dry malt with its dust* (the produce of 1 lb. of barley), as in pen 2, gives a slightly higher increase than the 1 lb. of *dry barley*, as in pen 1, but that in both periods, again, the *steeped barley* of pen 3 gives a better result than the *steeped malt and dust* of pen 4, and better, also, than either the *dry barley* of pen 1, or the *larger quantity* of malt and dust, as in pen 5; and it is remarkable, too, than in pen 3, with *steeped barley*, which on both periods is thus seen to give the best result of the five pens, there was a larger amount of mangolds consumed than in any of the other cases.

Comparing the *steeped* malt and dust with the *dry* malt and dust, we see that the *dry* gives the best results on the experimental period, and the *steeped* on the entire period: the discrepancy is due to the fact of a dissimilar condition of the animals in the two pens during the three weeks prior to the commencement of the experimental period—those on the *dry* malt losing in aggregate weight, whilst those on the *steeped* took better to their food at first, and did not, therefore, like the others, give afterwards an unnaturally rapid increase.

The barley and malt were at first both steeped for about 12 or 14 hours, but it was thought that the barley at least was not sufficiently softened, and therefore the time of soaking was extended to 36 hours or more for both malt and barley. This seemed to increase the relish with which the barley was taken, but the malt was almost entirely refused, and so long as it was thus prepared very few mangolds either were eaten, and within a few days all the sheep were seen to be deteriorating, and one was necessarily removed and afterwards killed. When, however, the short time of steeping was returned to, the animals took their food again, and progressed as well as before. Upon the whole, it may at least be said that there is much less necessity to steep malt than barley; and if the former be improved at all by such treatment. it should be exposed to it for a few hours only. The steeping of barley, however, from 30 to 40 hours, has been seen to increase the gross increase in live weight beyond that of the same amount of barley dry, of malt and dust, the produce of the same amount of barley, either dry or steeped, or than the dry malt and dust, the produce of one-fourth more barley.

These results are, it is admitted, wanting in some respects in that regularity which is calculated to give undoubted confidence in the conclusions to which they lead, and *it is possible* that the mangolds, containing as they do such a very large amount of saccharine matter, may on this account be somewhat less appropriate as an accompaniment to the malt than to the barley. Upon the whole, however, we see in the facts adduced in reference to this series, as well as to the one previously discussed, nothing whatever that is favourable to the malt, as compared with the barley; and, indeed, taking the results as they stand, the simpler process of steeping seems prominently to exceed in effect the more expensive one of malting. As, however, we have before remarked, *gross increase* is but a conditional indication of the progress of the animal, as we shall endeavour to illustrate further on.

As a check upon these trials between barley and malt in the shed, the remainder of the flock, after the selection for the experimental pens had been made, were allotted, sheep by sheep, according to weights, into two nearly equal sets. To one of these were given ½ lb. of barley and ½ lb. of clover-chaff per sheep per day; and to the other, malt and dust, the produce of ½ lb. of barley and ½ lb. of clover-chaff; the two lots being penned side by side in the field, and both allowed as many swedes as they chose to eat. The results are given in the following Table:—

TABLE 4.—Showing the Total and Average Weekly Increase per Sheep, of 27 Animals fed with Malt, Clover-Chaff, and Swedes; and 27 upon Barley, Clover-chaff, and Swedes, both lots in the field, during a period of 9 weeks.

Number of Sheep.	Description and Quantities of Food per Sheep per Week.	Total Weight in lbs. March 12.	Total Weight in lbs. May 14.	Total Gain in 9 Weeks.	Average Weekly Gain per Sheep.
27	3½ lbs. Clover-chaff; 3½ lbs. Barley; and Swedes, ad lib.	3602	4070	468	1·14¾
27	3½ lbs. Clover-chaff, Malt and Dust, produced from 3½ lbs. of Barley; and Swedes, ad lib.	3598	4035½	437½	1·12¾

In this experiment it cannot be considered that the food was either ill adapted to the habits or tastes of the animals, or to the season of the year at which the trial was made; and here again, as in the previous trials, which might by some, perhaps, be considered to be open to more or less objection, we have a result still in favour of the barley. The difference, it is true, is not great; yet, if it be not sufficient to show a decided superiority in the barley as compared with the malt, it nevertheless clearly indicates that there was no advantage in the use of the latter, the more expensive substitute; and since the result, as here given, does not stand alone, but is consistent with those of the two preceding trials, we must confess that at least, so far as the production of gross increase or live weight of sheep * is concerned, we can see nothing in the experiments which should favour the opinion

---

* The question as to the utility of malt as food for *oxen* is of course only settled by inference from these experiments with *sheep;* but even were it shown that the effects were greater with the former than with the latter, the cost of the malting process and the depreciation of the manure would have to be considered before deciding upon its use.

that the extended use of malt would be of any material benefit to the farmer.

The animals on oil-cake, in pen 6, are seen to show a much higher increase than those in any of the other pens. Since, however, they had not, at the commencement of the use of that food (with the exception of a single animal), regained the weights as at first put up, it is probable that the rapid increase afterwards may unduly represent the effects of the oil-cake, so that we do not much insist upon the comparisons they might otherwise afford in relation to the question of increase, though the results will not be open to objection on this account, when we come to the material one of the manure produced.

We now turn to a consideration of the *composition* of the several foods consumed; and in the following Table are given the results of analyses in reference to their contents in dry organic substance, in mineral matter, and in nitrogen:—

SERIES IV.

TABLE 5.—Showing the particulars of Sampling, and the per Centage of Dry Matter, Ash, Nitrogen, &c., in the several descriptions of Food consumed.

Description of Food, Particulars of Sampling, &c.					Per-centage Composition.					
Description of Food.	Period of Consumption.		Particulars and Date of Sampling.	Weight taken for Drying, &c.	Dry Matter.		Ash.		Nitrogen.	
	From	To			Inclusive of Ash.	Organic only.	In fresh substance.	In dry matter.	In fresh substance.	In dry matter.
				lbs. oz.						
Long Red Mangold, No. 1	Mar. 20	Apr. 17	Mar. 16	50 2	12·94	11·938	1·002	7·743	0·30	2 36
Ditto, No. 2 .	Apr. 17	May 29	Apr. 30	46 7½	13·14	12·161	0·979	7·447	0·28	2·18
				Mean . .	13·04	12·049	0·990	7·595	0·29	2·27
Barley . . .	Mar. 20	May 29	Mar. 12	2 samples, 100 oz. each	81·84	79·51	2·32	2·84	1·45	1·78
Malt . . .	Mar. 20	May 29	Mar. 12	2 samples, 100 oz. each	95·39	92·78	2·60	2·73	1·62	1·70
Malt Dust . .	Mar. 20	May 29	Mar. 12	2 samples, 100 oz. each	93·76	85·06	8·70	9·28	4·10	4·38
Oilcake. . .	Apr. 17	May 29	Apr. 26	2 samples, 25 oz. each	89·74	83·60	6·12	6·82	5·26	5·87

The two lots of mangold-wurzel were from different fields, No. 1 having been somewhat more highly manured than No. 2; and we find at the same time a slightly higher per-centage of nitrogen in the former than in the latter. This might have been due to changes in the clamp as the season advanced, the lot No. 2 being sampled and used later than No. 1. The relative per-centages of dry matter and of ash in the two specimens support the notion, however, that there was in reality some variation in the composition of the mangolds as produced; for with the higher manuring and higher per-centage of nitrogen we have a lower amount of dry substance, and a higher amount of ash, conditions which lead to the supposition that the plants were not so ripe when drawn from the land as the others; and it is not improbable that much of the bad effect of the mangolds at the commencement was, in fact, due to a deficient maturation, which both analysis and experience would indicate was more perfect as the season progressed. For our present purpose the mean composition of the two specimens will be taken as sufficiently near the truth.

The oil-cake here, as in former instances, is seen to contain a considerably higher per-centage of nitrogen than any of the foods tried by its side—indeed, weight for weight, it contains more than three times as much of that element as either the barley or the malt. The important fact is here seen also, that the *malt-dust* contains about 2½ times as high a per-centage of nitrogen as the screened malt; from which we learn, that although the quantity of "*dust*" bears but a small proportion to that of the malt, yet it may on this account be of much importance that it should not be separated from malt which is to be used as food. The "*malt-dust*" is, moreover, richer than the malt, in mineral matter, to a greater extent than in nitrogen. The malt is seen to be, weight for weight, considerably richer than the barley in dry organic substance, and rather so in mineral matter and in nitrogen; the weight of the malt, however, being much less than that of the barley which produced it, this superiority in composition is owing to the loss of water only; and we see, accordingly, that both mineral matter and nitrogen, though higher in the malt in the fresh state than in the barley in the same, are in a lower per-centage to the dry organic substance.

We shall now give such a sketch of the malting-process as will aid a conception of the losses to which the barley submitted to it is subject.

The malt used in the *first series* of experiments was made at the premises of Mr. William Lattimore, of Wheathamstead, who kindly observed and supplied an account of the weights and measures of the barley, and of the malt, and of the "dust" produced. The process was, however, in this case conducted very late in the malting season; and as the sampling for analysis was not made at the time of taking the weights, and as both malt and dust gained moisture, and therefore weight, very considerably after leaving the kiln-room, it was not thought that the results of further examination in the laboratory would be sufficiently trustworthy to repay the expenditure of labour.

In order to trace with more certainty some of the changes which take place during the process, permission was asked and freely granted by the Board of Excise to disturb the "floors," and remove samples for analysis from time to time, at the malting of Mr. Curtis of Harpenden, who kindly furthered the end in view by his assistance and advice.

The barley being all measured over, the weight of every eighth bushel being taken, an average was struck from which the actual weight of the barley to be steeped could be calculated. The grain, as is well known, first remains for a certain time in a cistern under water, where it swells considerably, having absorbed a large quantity of water, and lost by solution a considerable amount of saline matter and of organic substance containing nitrogen. The water being run off, the "*wetted*" grain is then removed to the "couch," where it remains for some time in a layer of from 12 to 16 inches in depth. It is afterwards spread out at a less depth on the floor, and is frequently turned over, and moved along by degrees from time to time, until it is conceived to be sufficiently grown, when, provided it has been in progress as long as is required by the rules of the Excise, it is dried in the kiln, where it is placed upon a frame of wire-gauze, which allows more or less of the young shoots or "*dust*" to pass through; this portion being then called "*kiln-dust,*" which being contaminated with the ashes from the furnace is rendered unfit for food. The remainder of the young shoots still adhering to the grain is separated by treading and screening, and the dust thus obtained is distinguished as "*malt-dust,*" and is valued for feeding purposes.

Samples were taken of the barley, of the wetted barley in the couch, and several times afterwards from the "floors," at intervals of about four days, and finally from the malt and the several qualities of dust; and the following Table provides a view of the results of analysis so far as already proceeded with, and as is essential for our present purpose, though specimens of all the products have been sufficiently dried for preservation, in order that the subject may be more fully worked out when leisure shall permit:—

SERIES IV.

TABLE 6.—Showing the Composition of Specimens of Barley, and products, taken at intervals as the Malting process proceeds.

Date of Sampling.	Length of Period (Days).	Description of Specimens.	Dry Matter.		Mineral Matter.		Nitrogen.	
			Inclusive of Ash.	Organic only.	In Fresh.	In Dry Matter.	In Fresh.	In Dry Matter.
Feb. 14	..	Dry Barley . . .	81·84	79·51	2·325	2·841	1·45	1·78
,, 18	4	In the couch . .	57·74					
,, 22	4	Growing	57·86					
,, 26	4	Ditto	58·22					
March 3	5	Ditto	58·83					
,, 6	3	Ditto	59·76					
,, 7	1	Malt	95·39	92·78	2·605	2·73	1·62	1·70
. .	..	Malt Dust & Kiln Dust	93·76	88·06	8·70	9·285	4·10	4·38

For the purposes of these determinations four samples were usually taken, each consisting of 100 ounces. All of these were immediately so far dried in a stove as to prevent their further growth, and render them fit for preservation. Two of the lots were then fully dried and burnt, thus giving the per-centages of dry-matter and ash respectively; the other samples remaining for further examination at any future time.

From the first column of Table 6 we learn that the barley acquired nearly half its weight of water in the steep-cistern, and that this amount was gradually reduced as the growth proceeded, for the per-centage of dry matter is seen to increase at a somewhat uniform rate of progression. The exhalation would appear to be somewhat more rapid as the process advances, for it is greater during the period from the 22nd to the 26th than in the previous one, notwithstanding 568 lbs. of water had been sprinkled upon the floor.

At the period of each of these samplings *the whole* of the grain on the floor was measured, and the weight of every eighth bushel taken, from which the average being struck, the actual weight on the floor could be determined.

The actual and the applied results of these measurings, weighings, samplings, dryings, &c., are arranged in the following Tables:—

SERIES IV.

TABLE 7.—Showing the Actual and Corrected Quantities of Barley, Malt, and Intermediate Products of the Malting Process.

Date of Sampling.	Length of Period (days).	Description of Specimens.	Number of Bushels.	Weight per Bushel.	Actual Quantities as Weighed in lbs.	Quantity taken for Samples.	Corrected Total Weight in lbs. Fresh.	Total Dry Matter in lbs.	Total Dry Organic Matter in lbs.	Total Mineral Matter in lbs.	Total Nitrogen in lbs.
Feb. 14	..	Dry Barley	144	53	7,632	..	7,632	6,246	6,068¼	177½	110·6
,, 18	4	In the couch	..	..	..	18¾					
,, 22	4	Growing .	251¼	41¾	10,482	25	10,504	6,077½			
,, 26	4	Ditto . .	288	36	10,368	25	10,414½	6,063¼			
Mar. 3	5	Ditto . .	295	33¾	9,941½	25	10,010¼	5,889			
,, 6	3	Ditto . .	..	..	..	25					
,, 7	1	Malt . .	144½	40½	5,837¾	..	5,907¾	5,635½	5,481¼	153·90	95·7
		Malt-dust . Kiln-dust .	.. ..	.. ..	190 } 76 }	..	266	249½	234¼	23·14	10·90

TABLE 8.—Showing the Proportion to 100 of Barley, of the several Products of the Malting Process.

Date of Sampling.	Length of Period (days)	Description of Specimens.	Fresh.	Dry Matter.	Dry Organic Matter.	Mineral Matter.	Nitrogen.
Feb. 14	..	Barley	100	100	100	100	100
,, 22	8	Ditto, growing	137	97·30			
,, 26	4	Ditto, ditto	136	97·07			
Mar. 3	5	Ditto, ditto	130	94·28			
Mar. 7	4	Malt	77·41	90·22	90·32	86·74	86·52
		Malt-dust Kiln-dust	3·48	3·99	3·85	13·04	9·85
		Total products	80·89	94·21	94·17	99·78	96·37
		Loss	19·11	5·79	5·83	0·22	3·63
		Total	100·00	100·00	100·00	100·00	100·00

We learn from Table 8, that although the weight of the produced malt was 22½ per cent. less than that of the barley which yielded it, yet the loss in dry substance was less than half as much; that of mineral matter and nitrogen is, however, proportionably greater than that of the gross dry vegetable substance. If, however, we include the "*dust*," or young shoots, as a product of the process, the loss is considerably lessened, for then we have a reduction of scarcely 6, instead of 10 per cent. of dry organic substance, and of scarcely 4 instead of 13½ per cent. of nitrogen. The loss in mineral matter also would appear from the figures to be still less considerable, when the *dust* is received into the calculations: as however the *crude ashes* of the products are here assumed to represent their mineral contents, it is obvious that the estimate of them in the Table is somewhat too high, and this indeed is the less to be doubted when the large amount of saline substances carried off in the steep water are borne in mind. It is worthy of especial remark that the nitrogen in the "dust" amounts to $\frac{1}{9}$th as much as is contained in the whole amount of malt produced! It is evident then, that when malt is used for feeding purposes, the important nitrogenous constituents of food are reduced by about 13 per cent. of the entire amount contained in the barley, unless the "dust" be also supplied to the animals. Whilst, judging from the qualities of other highly nitrogenous yet young and very succulent vegetable substances, it would appear by no means improbable that the 9 or 10 per cent. of the whole retained in the dust may have lost much of its nutritive properties. We have, however, seen on several occasions in the course of our report that the condition and quality of the *non*-nitrogenous constituents of food, as well as those of the nitrogenous ones, materially determines its productive effects; and if the results of experiments in the shed, or in the field, were found clearly to bear testimony as to the increased value of barley as food after being subjected to the malting process, we should be bound to conclude that by the conversion of the starch into sugar, or whatever the changes may be, the loss of the admittedly valuable nitrogenous compounds had been, to a certain degree, compensated. Our experiments with *sheep*, however, have led us to no such conclusion, whilst an analytical examination of the malting process has shown that in the barley submitted to it there is a reduction in some of its constituents which must obviously influence the value of the manure resulting from the consumption of the produced malt. Whilst, however, the results detailed do not in any degree encourage the idea that a much more extended use of malt for feeding purposes would prove to be of essential service to the farmer, we at the same time do not doubt, that, leaving out of view its cost, and the consideration of the comparative value of the manure produced, its occasional employment in admixture or alternation with other articles of food, may have a favourable influence upon the progress of the animal; and, indeed, when used as a relish rather than as a staple article of food, it is as such an useful and genial auxiliary. But, in speculating as to the economy of its adoption, the loss of manuring constituents must always be charged against it; whilst the cost of the process of manufacture, as estimated by Mr. Curtis, would, at the lowest calculation, amount to 2*s.* 6*d.* per quarter on the barley, provided the process were conducted as is usual for brewing purposes. It is probable, however, that a comparatively partial growth might yield a somewhat better result, with a cost and loss proportionally reduced; and such a process might indeed be suggested for trial as an improvement upon that of merely steeping, in cases where it may be deemed expedient to consume the highly elaborated* cereal grains upon the farm.

Having given some account of the per centage composition of the several foods employed in the experiments, and of the preparation of the malt, we now turn to the application of the information thus provided to the actual facts of the feeding experiments themselves.

In the next Table are given the total increase in live weights in the several pens during the 10 weeks of the experimental period, and the total amounts of *fresh food*, of *dry organic matter*, of *mineral matter*, and of *nitrogen* consumed to produce it.

---

* It is true that the samples of the cereal grains which are generally used as food for stock are not *as cereal grains* "highly elaborated;" though when compared with *other articles of cattle food of home production* they are so in an eminent degree, whilst they have been produced at a cost which would require that their beneficial effects upon the animal should be very considerable, if it is to be repaid by their consumption upon the farm to a great extent as the means of obtaining manure, *the ultimate object of which is the reproduction of the same description of produce*, but possibly of a better quality.

SERIES IV.

TABLE 9.—Showing the Total Amount of Food or Constituents consumed, and of Increase produced, in each Pen, during the Experimental Period.

	Total Increase in Live Weight in 10 Weeks.	Description of Food consumed.	Total Food Consumed Fresh.	Total Dry Organic Matter Consumed.	Total Mineral Matter Consumed.	Total Nitrogen Consumed.	Nitrogen in Increase at 3 perCent.	Nitrogen in Increase (at 3 perCent.) to 100 Consumed.
Pen 1		Barley (Ground but not Steeped)	280·0	222·64	6·51	4·06		
4	81	Mangolds	3867·0	465·93	38·28	11·21	2·43	15·91
Sheep		Total . .	4147·0	688·57	44·79	15·27		
Pen 2		Malt (Ground but not Steeped)	271·25	251·67	7·06	4·39		
5	105	Malt Dust	12·03	10·23	1·04	0·49		
Sheep		Mangolds	4693·60	565·53	46·46	13·61	3·15	17·03
		Total . .	4976·88	827·38	54·56	18·49		
Pen 3		Barley (Ground and *Steeped*).	280·0	222·64	6·51	4·06		
4	101½	Mangolds	5321·7	641·21	52·68	15·43	3·04	15·62
Sheep		Total . .	5601·7	863·85	59·19	19·49		
Pen 4		Malt (Ground and *Steeped*) .	217·0	201·34	5·65	3·51		
4	78	Malt Dust	9·6	8·16	0·83	0·39		
Sheep		Mangolds	4458·0	537·14	44·13	12·92	2·34	13·91
		Total . .	4684·6	746·64	50·61	16·82		
Pen 5		Malt (Ground but not Steeped)	335·0	310·82	8·72	5·42		
5	108	Malt Dust	15·0	12·76	1·30	0·61		
Sheep		Mangolds	5403·9	651·11	53·49	15·67	3·24	14·93
		Total . .	5753·9	974·69	63·51	21·70		
Pen 6	In 6 Weeks	Oil-Cake	142·8	128·14	8·73	7·51		
4	73	Mangolds	2635·9	317·59	26·09	7·64	2·19	14·44
Sheep		Total . .	2778·7	445·73	34·82	15·15		
6 Pens,		Total special food . .	1562½	1368½	46·35	30·44		
26	546½	Total mangold wurzel .	26380½	3178½	261·13	76·48	16·39	
Sheep		Total . .	27942¾	4547	307½	106·92		

The comparative indications of this Table will be more conveniently studied when the results are arranged to an uniform standard, as in those which shortly follow; but, attention may here be recalled to the enormous expenditure of food and its constituents to obtain a comparatively small amount of marketable produce, as shown in the aggregate result given at the foot of the Table. It is seen that for the production of 546½ lbs. of increased live-weight, there are consumed 1,562 lbs. of barley, malt, or oil cake, and 26,380 lbs., or nearly 12 tons, of mangold wurzel—together containing 4,547 lbs. of dry organic substance, 307½ lbs. of mineral matter, and 107 lbs. of nitrogen. It may be observed too that, on the supposition that the increase produced pretty constantly contained 3 per cent. of nitrogen, the amount of this element stored up in the animal, in proportion to that supplied in the food, is more uniform throughout the pens, and that the average amount is greater in this than in the former series of experiments.

In the following Tables are given the amounts of food or constituents consumed weekly in each pen, to every 100 lbs. live weight of animal, and also the amounts consumed *to produce* 100 lbs. increase in live weight.

In the first division of Table 10 we at once observe that there was a considerably larger quantity of mangold-wurzel consumed per week to an equal live weight of animal, with the *steeped barley*, than with any of the other foods; and if we turn to the second division of the Table, we shall gather that this cannot altogether be accounted for by the demand of the system for non-nitrogenous organic matter, unless, indeed, there was in this case a more rapid expenditure of food than in the others, which however not improbably was the case, since in this instance *the increase* was greater than in the rest. There is, nevertheless, some indication that such demand did so operate to a certain extent. Thus, taking the instances of pens 1 and 3, in both of which the special food was barley, we find that with the smaller amount of dry organic substance in the barley (of which the composition, though not the condition, would of course be similar in the two cases) of pen 3 than in that of pen 1, there is at the same time in the former a more than compensating increased amount consumed in the mangolds; and again, taking pens 2 and 4, with malt, we see that with the smaller amount of dry organic matter consumed in the malt in pen 4, there is at the same time an increased amount in the mangolds. The 5th pen, also having malt as a special food, is, however, quite an exception to this rule; for with about one-fourth more dry organic substance in the malt than in either pen 2 or pen 4, we have at the same time a larger quantity consumed in the mangolds, the cause of which may possibly be sought in the fact before alluded to, of a more active circulation and passage of the food in and through the body, dependent here probably upon the larger amount of the more fully elaborated and less amount of the crude constituents of the food as supplied in the malt. It is interesting to observe, too, that, excepting pen 6, there is almost identically the same order observed in the supply of nitrogen as in that of the dry organic matter in the respective foods of the several pens. This is a result very contrary to that obtained in the former series, but as there was here a much more uniform proportion of the nitrogenous to the *non*-nitrogenous compounds in the several foods than in those of the other cases, it is not in any degree opposed to the conclusion before arrived at, viz. that *consumption* is, within a certain limit, regulated more by the amount of the

SERIES IV.

Table 10.—Showing the Weekly Consumption of Fresh Food, of Dry Organic Matter, of Mineral Matter, and of Nitrogen, to each 100 lbs. live weight of Animal.

	Description of Special Foods.	Fresh Food consumed			Dry Organic Matter consumed			Mineral Matter consumed			Nitrogen consumed		
		In Special Food.	In Mangold Wurzel.	In Total Food.	In Special Food.	In Mangold Wurzel.	In Total Food.	In Special Food.	In Mangold Wurzel.	In Total Food.	In Special Food.	In Mangold Wurzel.	In Total Food.
Pen 1	Barley	5·00	69⅛ lb.	74·125	3·97	8·32	12·29	·116	·68	·796	·070	·200	·27
„ 2	Malt and Malt Dust	4·01	66½	70·51	3·76	8·01	11·72	·115	·65	·765	·069	·192	·261
„ 3	Barley (steeped)	4·77	90½	95·27	3·79	10·90	14·69	·110	·89	1·000	·069	·262	·331
„ 4	Malt and Malt Dust (steeped) . .	3·78	74½	78·28	3·50	8·97	12·47	·108	·73	·838	·065	·216	·281
„ 5	Malt and Malt Dust (extra quantity) . .	4·86	75·	79·86	4·49	9·03	13·52	·140	·74	·880	·083	·217	·300
„ 6	Oilcake	4·28	79·	83·28	3·57	9·51	13·08	·260	·78	1·040	·225	·229	·454
	Mean of the Six Pens . . .	4·45	75·77	80·22	3·838	9·12	12·96	·141	·74	·886	·096	·219	·316

Table 11.—Showing the Consumption of Fresh Food, of Dry Organic Matter, of Mineral Matter, and of Nitrogen, in each Pen, to produce 100 lbs. increase in live weight.

	Description of Special Foods.	Fresh Food consumed			Dry Organic Matter consumed			Mineral Matter consumed			Nitrogen consumed		
		In Special Food.	In Mangold Wurzel.	In Total Food.	In Special Food.	In Mangold Wurzel.	In Total Food.	In Special Food.	In Mangold Wurzel.	In Total Food.	In Special Food.	In Mangold Wurzel.	In Total Food.
Pen 1	Barley	345·5	4774·	5119·5	274·72	575·21	849·93	8·03	47·26	55·29	5·00	13·84	18·84
„ 2	Malt and Malt Dust	269·75	4470·	4739·75	249·69	538·59	788·28	7·77	44·25	52·02	4·65	12·96	17·61
„ 3	Barley (steeped)	275·75	5243·	5518·75	219·26	631·72	850·98	6·41	51·90	58·31	3·99	15·20	19·19
„ 4	Malt and Malt Dust (steeped) . .	290·5	5715·25	6005·75	268·95	688·63	957·58	8·38	56·58	64·96	5·01	16·57	21·58
„ 5	Malt and Malt Dust (extra quantity) . .	324·	5003·5	5327·5	300·02	602·87	902·89	9·36	49·53	58·89	5·59	14·51	20·10
„ 6	Oilcake	195·5	3610·75	3806·25	163·43	435·05	598·48	11·96	35·74	47·70	10·28	10·47	20·75
	Mean of the Six Pens . . .	283·5	4802·75	5086·25	246·01	578·67	824·68	8·65	47·54	56·19	5·75	13·92	19·67

non-nitrogenous, than of the *nitrogenous* constituents supplied in the food; whilst the much larger amount of the latter consumed in the oil-cake pen than in any of the others, with, at the same time, a nearly identical amount of the former, would seem to afford confirmation of this supposition.

Turning to Table 11, we observe a striking uniformity in the quantities of nitrogen consumed to produce a given amount of increase. It is seen, however, that the case most exceptional in this respect is that of the *dry malt* in pen 2, in which, according to the Table, a less amount both of dry organic matter and of nitrogen has been required than in any of the other cases with malt or with barley. It has been before explained, however, that the indications of that pen, as calculated on the experimental period, were probably more open to objection than those of the rest, whilst the results of pens 4 and 5, the one with *steeped* and the other with the larger amount of *dry* malt, would seem to disprove the correctness of the conclusions to which the figures as they stand might lead. It has also been supposed that the effects due to the oil-cake in pen 6 may probably be somewhat overstated in the Tables: if this be not the case, however, the figures in this Table may be taken to show, that in the pen with oil-cake, wherein the consumption of nitrogen, both within a given time and in proportion to other organic constituents, was half as great again as in any of the other pens, the amount of it consumed to produce a given amount of increase is almost identical with the average of the other pens, whilst that of the *gross dry organic matter* is very much less than in any of the other instances. This fact, if it be to be relied upon, would lead us to conclude that the nitrogen taken in the pens with barley and malt, though proportionally uniform throughout, was insufficient in amount to turn to full account the large quantity of highly perfected *non*-nitrogenous compounds as supplied in the cereal grains in these cases. The weekly supply of it, indeed, was not much below the average in the former series, but in these the food was rarely, if ever, so rich in the more perfected non-nitrogenous constituents as in the instances at present under notice.

It was our intention to have given the results of a fifth series of experiments with sheep before leaving the question of the *gross increase in live weight of the animal;* as, however, the details connected with this branch of our subject have already extended beyond the limits originally anticipated, we shall defer, until some future occasion, the further consideration of such matter. Before closing the present article, however, it will be useful to provide in a tabular form a summary of some of the results already discussed, and to this we shall subjoin a collected statement of any of such results of other observers in relation to this subject as we at present remember to have met with.

SUMMARY.

TABLE 1.—Showing the Weekly Consumption of Dry Organic Matter and of Nitrogen for each 100 lbs. Live Weight of Animal, as indicated by the results of the several series of Experiments with Sheep.

DRY ORGANIC MATTER.

	SERIES 1. Special Food: Oilcake, Oats, Clover-chaff; Standard Food: Swedes.	SERIES 2. Special Food: Oilcake, Linseed, Barley, Malt; Standard Food; Clover-chaff.	SERIES 3. Norfolk Whites, grown by Mineral Manure; Ditto and Ammoniacal Salts; Ditto and Rape-cake; Ditto and Rape-cake and Ammoniacal Salts.	SERIES 4. Special Food: Barley (dry), Malt (dry), Barley (steeped), Malt (steeped), Extra Malt (dry), Oilcake; Standard Food: Mangolds.
Pen 1	12·31	16·71	14·33	12·92
Pen 2	12·94	15·87	13·00	11·72
Pen 3	14·76	16·37	12·50	14·69
Pen 4	11·24	16·54	11·25	12·47
Pen 5	. .	. .	. .	13·52
Pen 6	. .	. .	. .	13·08
Mean . .	12·81	16·37	12·75	12·96

NITROGEN.

	SERIES 1. Special Food: Oilcake, Oats, Clover-chaff; Standard Food: Swedes.	SERIES 2. Special Food: Oilcake, Linseed, Barley, Malt; Standard Food: Clover-chaff.	SERIES 3. Norfolk Whites, grown by Mineral Manure; Ditto and Ammoniacal Salts; Ditto and Rape-cake; Ditto and Rape-cake and Ammoniacal Salts.	SERIES 4. Special Food: Barley (dry), Malt (dry), Barley (steeped), Malt (steeped), Extra Malt (dry), Oilcake; Standard Food: Mangolds.
Pen 1	0·39	0·60	0·24	0·27
Pen 2	0·25	0·51	0·29	0·26
Pen 3	0·26	0·41	0·31	0·33
Pen 4	0·17	0·40	0·39	0·28
Pen 5	. .	. .	. .	0·30
Pen 6	. .	. .	. .	0·45
Mean . .	0·27	0·48	0·31	0·31

MINERAL MATTER.

	SERIES 1.	SERIES 2.	SERIES 3.	SERIES 4.
	Special Food: Oilcake, Oats, Clover-chaff; Standard Food: Swedes.	Special Food: Oilcake, Linseed, Barley, Malt; Standard Food: Clover-chaff.	Norfolk Whites, grown by Mineral Manure; Ditto and Ammoniacal Salts; Ditto and Rape-cake; Ditto and Rape-cake and Ammoniacal Salts.	Special Food: Barley (dry), Malt (dry), Barley (steeped), Malt (steeped), Extra-Malt (dry), Oilcake; Standard Food: Mangolds.
Pen 1	0·71	1·45	1·03	0·79
Pen 2	0·60	1·28	1·06	0·76
Pen 3	0·95	1·25	1·11	1·00
Pen 4	0·61	1·24	1·09	0·83
Pen 5	. .	. .	. .	0·88
Pen 6	. .	. .	. .	1·04
Mean . .	0·72	1·30	1·07	0·88

SUMMARY.

TABLE 2.—Showing the Consumption of Dry Organic Matter and of Nitrogen to produce 100 lbs. Increase in Live Weight, as indicated by the results of the several series of Experiments with Sheep.

DRY ORGANIC MATTER.

	SERIES 1.	SERIES 2.	SERIES 3.	SERIES 4.
	Special Food: Oilcake, Oats, Clover-chaff; Standard Food: Swedes.	Special Food: Oilcake, Linseed, Barley, Malt; Standard Food: Clover-chaff.	Norfolk Whites, grown by Mineral Manure; Ditto and Ammoniacal Salts; Ditto and Rape-cake; Ditto and Rape-cake and Ammoniacal Salts.	Special Food: Barley (dry), Malt (dry), Barley (steeped), Malt (steeped), Extra Malt (dry), Oilcake; Standard Food: Mangolds.
Pen 1	817·25	1424·0	2288·25	849·93
Pen 2	786·25	1433·5	1321·25	768·28
Pen 3	838·50	1504·0	2371·25	850·98
Pen 4	1015·00	1723·5	. .	957·58
Pen 5	. .	. .	. .	902·89
Pen 6	. .	. .	. .	598·48
Mean . .	864·25	1521·25	1993·58	824·68

NITROGEN.

	SERIES 1. Special Food : Oilcake, Oats, Clover-chaff; Standard Food : Swedes.	SERIES 2. Special Food : Oilcake, Linseed, Barley, Malt; Standard Food : Clover-chaff.	SERIES 3. Norfolk Whites, grown by Mineral Manure; Ditto and Ammoniacal Salts; Ditto and Rape cake ; Ditto and Rape-cake and Ammoniacal Salts.	SERIES 4. Special Food : Barley (dry), Malt (dry), Barley (steeped), Malt (steeped). Extra Malt (dry), Oilcake ; Standard Food ; Mangolds.
Pen 1	26·59	50·92	39·00	18·84
Pen 2	16·24	45·90	29·50	17·61
Pen 3	16·23	37·26	60·75	19·19
Pen 4	16·13	42·19	. .	21·58
Pen 5	. .	. .	. .	20·10
Pen 6	. .	. .	. .	20·75
Mean . .	18·80	44·07	43·08	19·67

MINERAL MATTER.

	SERIES 1. Special Food : Oilcake, Oats, Clover-chaff; Standard Food : Swedes.	SERIES 2. Special Food : Oilcake, Linseed, Barley, Malt; Standard Food : Clover-chaff.	SERIES 3. Norfolk Whites, grown by Mineral Manure ; Ditto and Ammoniacal Salts ; Ditto and Rape-cake ; Ditto and Rape-cake and Ammoniacal Salts.	SERIES 4. Special Food : Barley (dry), Malt (dry), Barley (steeped), Malt (steeped), Extra Malt (dry), Oilcake ; Standard Food : Mangolds.
Pen 1	48·12	124·07	164	55·29
Pen 2	36·97	116·23	106¾	52·02
Pen 3	54·98	114·90	212¾	58·31
Pen 4	56·74	130·43	. .	64·96
Pen 5	. .	. .	. .	58·89
Pen 6	. .	. .	. .	47·70
Mean . .	49·20	121·40	161·17	56·19

TABLE, showing the Consumption of Food and the Increase of Animal per Week, for each 100 lbs. Live Weight,* as recorded by various observers.

BEASTS.

Description of Animal.	Number of Animals	Duration of Experiment.		Authority.	Food consumed per Week to each 100 lbs. live weight of Animal.			Increase per Week upon each 100 lbs. live weight.	
					Description.	Quantities.			
		Wks.	Days			lbs.	oz.	lbs.	oz.
Oxen . .	4	5	0	H. S. Thomson	Linseed . .	0	13⅓	1	8
					Bean-meal .	2	12½		
					Straw & turnips	. .			
Oxen . .	4	4	0	H. S. Thomson	Oilcake . .	1	13	1	1⅓
					Bean-meal .	1	13		
					Turnips . .	. .			
Oxen . .	6	22	0	Mr. Postle .	Peas . . .	1	13	0	14
					Linseed . .	0	8		
					Turnips . .	64	0		
Oxen . .	6	22	0	Do.	Oilcake . .	3	5	0	13½
					Turnips . .	66	0		
Oxen . .	27	9	0	J. H. Leigh .	. .	. .		1	4¾
Do. . .	30	10	5	Ditto . .	. .	. .		2	12

---

* It is obvious that, if description of animal, breed, age, length of continuance upon the same food, &c., have any influence upon the progress of the animal, these Tables of weekly consumption of food, and weekly gain upon 100 lbs. of live weight, cannot be taken as supplying facts in every respect strictly comparable with each other. They may, however, be taken as affording some useful information as to the average result of the feeding process, by which at the same time some judgment may be formed as to how far our own results agree in the main with those of other observers. The method adopted in the construction of the Tables, with the view of bringing to one uniform standard results obtained under such dissimilarity of circumstance, has been to calculate the food consumed and the increase obtained upon the *mean* weight of the animal, as illustrated by the following example:—

Five Downs fed at Rothamsted for 14 weeks, upon oats and swedes, gained 131½ lbs. The weights were:—

At commencement	558
At conclusion	689·5
	2)1247·5
Mean weight . . .	623·75 lbs.

The total gain for 14 weeks being 131½ lbs., the weekly gain would be 9·4 lbs. Then say—

623·75 : 9·4 : : 100
100

623·75)940·000(1·5 = 1 lb. 8 oz.
623·75

316·250
311·875

weekly gain upon 100 lbs. live weight, the food being estimated in like manner.

TABLE, showing the Consumption of Food and the Increase of Animal per Week, for each 100 lbs. Live Weight, as recorded by various observers.

SHEEP.

Description of Animal.	Number of Animals	Duration of Experiment.		Authority.	Food consumed per Week to each 100 lbs. live weight of Animal.			Increase per Week upon each 100 lbs. live weight.	
					Description.	Quantities.			
		Wks.	Days			lbs.	oz.	lbs.	oz.
Cotswold Ewes	10	8	0	Rev. A. Huxtable	. .	.	.	2	3
Do.	10	8	0	Do.	. .	.	.	1	8½
Leicester Lambs in Shed	10	4	0	Do.	1st Week Swedes 3 last Weeks Oilcake Barley	. . .	. . .	3	9½
Leicester Lambs in Field	10	4	0	Do.	Swedes only	.	.	1	12¼
Downs Wether Tegs	30	10	5	J. B. Lawes	. .	.	.	2	9½
Downs	5	14	0	Do.	Oil-cake Swedes	5 72	3½ 0	1	8
Do.	5	14	0	Do.	Oats Swedes	6 66	14 7	1	10½
Do.	5	14	0	Do.	Clover Chaff. Swedes	6 91	7½ 2¼	1	12¼
Do.	4	14	0	Do.	Swedes	98	5½	1	1¾
Do.	5	19	0	Do.	Oil-cake Clover Chaff.	5 16	2 2¾	1	3
Do.	5	19	0	Do.	Linseed Clover Chaff.	5 14	2 12	1	1¾
Do.	5	19	0	Do.	Barley Clover Chaff.	5 15	3¼ 9	1	1½
Do.	5	19	0	Do.	Malt Clover Chaff.	4 15	15¼ 10¾	0	15½
Do.	8	23	2	Do.	. .	.	.	1	0¾
Do.	5	9	0	Do.	Clover Chaff. Swedes	4 91	8½ 12¾	1	5½
Do.	5	9	0	Do.	Clover Chaff. Swedes	4 87	2 4	1	6½
Do.	5	9	0	Do.	Clover Chaff. Swedes	4 79	9¾ 6¾	1	1¾
Sheep	5	16	0	Morton	Oats Swedes	5 100	13 0	1	3
Do.	5	16	0	Do.	Oats Swedes	5 74	15 0	1	5¾
Do.	5	16	0	Do.	Oats Swedes	5 65	14 0	1	3
Do.	5	16	0	Do.	Oats Swedes	6 47	0 0	1	8

Description of Animal.	Number of Animals	Duration of Experiment.		Authority.	Food consumed per Week to each 100 lbs. live weight of Animal.			Increase per Week upon each 100 lbs. live weight.	
					Description.	Quantities.			
		Wks.	Days			lbs.	oz.	lbs.	oz.
Sheep . .	5	16	0	Morton . .	Oats . . . Swedes . .	5 45	11 0	1	2
Sheep, Leicester . .	5	12½		Lord Radnor .	Hay . . . . Pulse . . . . Swedes . .	5 10 133	3 9 0	2	3
Southdown .	5	12½		Do. . . .	Hay . . . . Pulse . . . . Swedes . .	6 12 180	3 5 0	2	15½
Half-breds .	5	12½		Do. . . .	Hay . . . . Pulse . . . . Swedes . .	4 9 138	6 3 0	2	0¾
Cotswold .	5	12½		Do. . . .	Hay . . . . Pulse . . . . Swedes . .	4 8 144	8 12 0	2	3
Leicester .	5	18	0	Do. . . .	Grass . . .	..		1	1¾
Southdown .	5	18	0	Do. . . .	Do. . . .	..		1	2¼
Half-breds .	5	18	0	Do. . . .	Do. . . .	..		1	4¾
Cotswold .	5	18	0	Do. . . .	Do. . . .	..		0	14¾
Leicester .	5	12	0	Do. . . .	Hay . . . Swedes . .	11 174	0 0	2	0¼
Southdown .	5	12	0	Do. . . .	Hay . . . Swedes . .	10 175	14 0	1	12
Half-breds .	5	12	0	Do. . . .	Hay . . . Swedes . .	11 180	1½ 0	2	3
Cotswold .	5	12	0	Do. . . .	Hay . . . Swedes . .	10 178	0 0	1	13¼
Leicester Lambs .	22	17	0	Mr. Rt. Woods	Oilcake . . Barley . . Turnips . .	2 2 ad	11½ 11½ lib.	1	8¼
Half-breds .	22	17	0	Do. . . .	Oilcake . . Barley . . Turnips . .	2 2 ad	11½ 11½ lib.	1	9¾
Southdown .	4	10	0	J. B. Lawes .	Barley, dry . Mangolds .	5 69	0 2	1	6¾
Do. . .	4	10	0	Do. . . .	Barley, steeped Mangolds .	4 90	12 8	1	11½
Do. . .	5	10	0	Do. . . .	Malt, dry . Mangolds .	4 66	1½ 8	1	7¾
Do. . .	4	10	0	Do. . . .	Malt, steeped. Mangolds	3 74	12½ 8	1	4¾
Do. . .	5	10	0	Do. . . .	Malt, dry . Mangolds .	4 75	13¾ 0	1	8
Do. . .	4	6	0	Do. . . .	Oilcake . . Mangolds .	4 79	4½ 0	2	1¾

The reader of the foregoing pages will at once discern that the results as thus far detailed are not alone fitted for direct application to those general questions which, in our introductory remarks, we have stated it to be the object of this investigation to elucidate; it being obviously essential to such purpose that the collateral information as to the composition of the increase and of the manure should also be before us. Some few observations, however, upon the Tabulated Summary which has been given, as well as upon the collected results of other experimenters by the side of our own, might with advantage have been offered in this place, had our time and space permitted it. The omission is, however, perhaps the less to be regretted, since the remarks which have been made in the course of the detailed examination of the results may probably serve, in the mean time, sufficiently to guide the observations of the intelligent reader to some of the chief points of interest in these concluding Tables, whilst, in re-opening the subject in our next communication, a suitable opportunity will occur for passing in review the facts already recorded, which, indeed, may now be accomplished with less fear of undesirable repetition. We propose, then, in our next, first to recall attention to the facts of more prominent import which have thus far been brought forward, relating to the consumption of food or its constituents, and the increase in gross live weight obtained; then to consider in detail, first the question of the composition of increase, and secondly that of the manure produced, each in relation to the general and special characters of the foods employed; and, this being accomplished, we shall be prepared to direct attention to the more important bearings of the results, especially in relation to the characters and composition of manuring substances generally.

XVI.—*On increasing our Supplies of Animal Food.* By JOHN C. MORTON.

PRIZE ESSAY.

AGRICULTURE is an art which, by its plants and its animals, enables us to gather up and assort those atoms or particles existing in the air and soil and in vegetables, respectively, which, thus assorted and combined, are food for man.

That is the *theory;* and the *practice* bears it out: for in reality the farmer does but direct a succession of processes whose effect is to detach these particles from useless positions and connexions in earth, air, and water, and from comparatively useless positions in the substance of plants, in order, with such materials, to erect the structure of the ripened crop in the one case, or of the fattened animal in the other. His every act of cultivation, by assisting the action of atmospheric solvents, loosens these atoms from previous combinations in the soil—his manuring is a direct addition to them—his draining furthers their more ready transmission to the roots of his plants—the hoeing by which he stimulates the growing crop accelerates their assimilation into its substance; all the details of preparation have for their aim the easiest and most economical collection of these particles for the use of man, either as vegetable food or as MEAT on the bodies of fattening animals.

These remarks may be too general, but they will serve as an introduction to our subject, by showing—what, however, is evident, almost at first sight without them—that increase of animal food, as of every other agricultural product, is to be looked for in the promotion of an increased fertility of the soil. It is true that our produce of meat depends much on our animals being of the largest growth in their best parts and of rapid growth throughout—much on their being fed on well-selected and rightly-prepared food in warmth, and comfort, and health—and much on those crops being grown which best supply this food, and those kinds of each which are most productive of the parts required; but it is the soil *itself*[*] whose substance furnishes that of the plant in the first place, and that of the animal in the end; and it is to the fertility of his *fields* that the farmer should first look who aims at increasing their productiveness in this as in any other respect.

For this reason I venture to depart somewhat from the order in which the Society has dictated the subject, and postponing consideration of the lean stock supplies, and of other statistical

---

[*] I do not forget that the greater part of a plant is supplied by the air: but I may overlook that here, as the consideration of it would not affect the argument.

parts of the question, to discuss, in the first place, those answers which seem to claim the earliest consideration. The question is—

How can we best increase our supplies of animal food?

And the answers are:—

1. First; by increasing the fertility of our land; by increasing in the soil the amount of that matter which, after union with contributions from air and from water in the substance of growing plants, really supplies the very particles which are ultimately gathered up by animal digestion into the form of meat.

2. Secondly; after the attainment of a maximum fertility of land, by such a skilful use of the building materials it supplies, as shall result in the erection, along with the due proportion of grain and other vegetable produce for the use of man, of a maximum of nourishing food for the use of animals. Under this head the questions of, arable *versus* pasture-land—rotations of crops—selections of the best plants, &c.—will require consideration.

3. And thirdly; after the attainment of this maximum produce of food, by the selection of such animals and the adoption of such modes of treating them as shall occasion the least waste in the conversion of this food. Here, the qualities of our different breeds of cattle and sheep as regards early maturity, proportion of offal, &c.—the various modes of preparing and administering food—and the methods of housing and treating live stock will need consideration.

When perfect fertility shall have been attained, and the best crops in the best order of succession shall have been employed to develop it; and when the best animals, under the best circumstances shall have been fed upon the produce of them, then will any farm have attained its maximum productiveness of animal food. And after considering the successive steps to so desirable an end, it will be necessary to refer to the other points which the Society has named, and to inquire how far economy in the process is served by the *purchase* of lean stock instead of *breeding* it, or by keeping animals fattening to greater age than is common; and taking a national view of the subject it will also be right to inquire what dependence for the supply of lean stock can be placed on the sources now in operation.

It will be seen that the subject the Society has proposed is thus a very extensive one, requiring, if fully treated, a discussion of what is in fact the whole practice of agriculture. Space, however, would not be allowed me to enter into such detail as might be desirable on all the branches of the inquiry; and I shall therefore give, as briefly as possible, the earlier answers, stating at full length only those more immediate ones which, indeed, might alone, at first sight, appear to belong to it.

I. First; it is to an increased fertility of the soil that we must look as the source of any great or general increase in the produce of animal food.

The soil, not to speak of its exclusively mechanical offices, is itself the food of plants; it is also a store-room of their food; it is a laboratory in which their food is prepared; and it is the channel of conveyance through which their food is administered. Its fertility depends on all these circumstances: the soil is most fertile in relation to any particular *plant* when, in addition to possessing a texture suitable to its growth, it is composed of material whose gradual decomposition furnishes the food the plant requires; and fertility is at its highest in relation to any particular *climate* when in addition to a texture fitting it for the growth of the most valuable plants which that climate can ripen, the soil is in all its characters of storehouse, laboratory, and food vehicle, the best fitted to meet the extremes of heat and cold, drought and moisture, to which it is subjected. By the improvement of a soil in any of these respects its fertility may be increased; as to its texture, this may be altered to a standard adapting it for a better rotation of crops or fitting it more perfectly to the climate under which it lies; as a storehouse it may be kept more constantly full by less expensive methods; as a laboratory, liming may be used to convert its inert or poisonous "chemicals" into nourishing food, and draining will with the best effect introduce air and rain-water into its mixtures: while as the food vehicle, if its action be too rapid and wasteful, it may be retarded by claying or marling; if too slow, it may be accelerated by drainage. But, to drop the language of theory, we have not space to allude particularly to the modes of improving the texture of soils which marling and draining and burning them supply, nor to refer at any length to the increased fertility occasioned by a more economical management of home-made manures and by the use of purchased fertilisers, as guano, bone-dust, &c. I have not room to estimate here in detail the benefit arising from the more extensive cultivation of manure-producing crops, as the turnip, mangold wurzel, &c., and from the fallow cultivation of which these crops admit during their growth; nor can I do more than merely allude to drainage as the great fertiliser, which it is by admitting the air and all its food particles into the land, by subjecting the soil throughout its substance to the action of atmospheric solvents, and by facilitating the conveyance of the food it thus provides and prepares to the roots of plants. All these are subjects proper for long and interesting essays of themselves; I can do little more than merely enumerate them here in reference to their influence on the ultimate products of agriculture, as they induce an increased produce of vegetable food on which a more numerous herd of cattle may be fed.

The connexion between all these means and the resultant produce of meat is most intimate. It is not merely that the extra manuring *induces* the extra crop—the manuring furnishes the very building material out of which the increased produce is *made.* Those very atoms of nitrogen and of phosphorus you are adding in guano—those very particles of potash and soda you are detaching from impracticable positions in the soil by the influences which drainage has brought to bear upon them—those very atoms of carbon which your plants, vigorous owing to more thorough cultivation, are extracting from the air in the sunshine, may travel various roads, but they will come to an ultimate residence side by side in the flesh and the blood of the fattening animal. The various additions you make to your soil, the fertility you extract from it, may indeed be said to "occasion" the increased produce of meat which succeeds them, but it is in the same way as the stone and the lime *occasion* the buildings of which they are the very substance and material.

There is one topic connected with this branch of our inquiry to which we may usefully refer; and this is the fact that the processes of meat-manufacture when once commenced are conservative of their own continuance through the thus maintained fertility of the soil. The more turnips the more stock and the more meat; the more stock the more manure; and the more manure the more turnips again. There is no way of insuring and increasing fertility in land more certain of success than that of keeping a large head of stock upon it. Mr. Lawes has satisfactorily illustrated this in the eighth volume of the Society's Journal. The manufacture of meat is not only a thing desirable on its own account, but it is the very method of all others to insure a larger produce of everything else. There is no cheaper way of supplying the soil with the material which is to feed the wheat plant as well as the turnip, than that of feeding a certain quantity of meat upon the land, and applying the manure made meanwhile.

So certain is this truth that we may safely quote Mr. Lawes when he says of the farmer, that "so long as a due relation between his production of meat and export of corn were maintained, there would be no fear of an exhaustion of the soil, even if he grew no green crops whatever." We need not follow the technical argument urged in proof and illustration of this opinion. It is sufficient to appeal to all agricultural experience on the subject. Other things being equal, the greater the produce of meat upon a farm, the greater also, in general, will be the produce of corn.

Increased fertility, then, not only lays the only sure foundation for an increase in the produce of meat, but is itself augmented by the very processes of the manufacture to which it gives rise.

II. Secondly; having attained a perfect fertility, our second point is to develop it in the manner most useful to feeders of stock. Having reached the highest capability of land to grow plants, our next object must be so to select and so to cultivate the plants to be grown that there may be a maximum of food for animals. Of course agriculture is not a merely meat-producing art: it has other products, among which its profits as a business lie. The methods by which the greatest weight of meat is to be obtained are thus not likely to be adopted on a large scale, or except for experiment. Possibly a climate may exist in some parts of the country—in western Ireland for instance—so unsuited for the growth of grain that meat might be made the exclusive staple of agricultural manufacture, and there perhaps farmers might be reasonably induced to pay exclusive attention to the cultivation of those plants on which sheep and cattle feed; but here, grain and other crops for the direct use of man have to be provided, and though, to be sure, our produce of them is dependent on the manure made in meat manufacture, yet to them directly, and not to the others, has the farmer hitherto been forced to look as the source whence to meet the rent and labour outgoings of the farm. In those cases where these are large—where intensive farming prevails—it is still a problem for solution how to convert green crops with sufficient profit to induce their exclusive cultivation; and this, not to speak of the straw of grain-crops, which is, one might almost say, necessary to the process, will long and perhaps always render a rotation of both kinds on the land indispensable.

There is indeed a state of things prevalent over a large part of the island, which it must be acknowledged is easily productive of both rent and profit, in which the land is made to yield but one class of plants in constant succession—a class indigenous to the soil, and thus requiring but little attention from the cultivator, and here meat, or other animal produce, is the exclusive result of agriculture; but this system remains and will remain chiefly because its labour outgoings are so small. Over large districts where it prevails, a more artificial farming might be profitably substituted.

It will be our first duty to compare grass and arable land in reference to our particular subject. But I must confess that it will not be any result to which that comparison may lead that will justify or condemn the continuance of the former. It is the value of the *free* produce—the worth of the remainder after all outgoings have been deducted from the gross returns of the land, except those for division between the only parties immediately concerned in the proposition, that will determine whether the condition to which those are owing shall continue. And it must be confessed that over a large extent of good land now in pasture, the deduction on account of labour is so small, and the gross produce so considerable, that neither landlord nor farmer has any interest in breaking them up. Land yielding 12 or 15 tons of green food per acre yearly without any labour but that of repairing the fences which divide it, destroying the docks and the thistles which invade it, and supplying manure to maintain it, is producing more at less expense than perhaps it could do in any other condition. It is not in such cases as this, then, that our comparison must be made: there is much *poor* pasturage in the country, which lies nevertheless under a climate proper for arable farming; and it is about this that the question obtains.

There is no doubt that over much of this which, though drained, would not yield 30 tons of green food per acre in four years, an equal quantity might, if it were properly cultivated, be obtained in turnips and clover, with probably 2 tons of straw and 60 or 70 bushels of grain in the same time. Grass is probably more nourishing per ton than turnips; but when the one is consumed in all weathers by unsheltered animals, and the other in well-bedded houses, it may be doubted whether the resultant produce of meat may not be about the same in either case—with a clear balance of course of so much grain as food for man in favour of arable culture. But this matter requires a detailed estimate, and this I shall endeavour to give, merely premising that the above figures are not given without reason; as on the farm I write from, three quarters of which were formerly grass, a stock of about 40 head of oxen fattening to 60 or 70 stones, and between 200 and 300 sheep fattening to 24 lbs. a quarter, with 50 or 60 pigs, are now kept during winter, and about half those numbers during summer, where formerly a herd of 25 cows and about 20 yearling and 2 year-old heifers, with a few pigs, were maintained in store condition; while, in addition to the above, the land now permits an annual sale off it of about 4000 bushels of wheat.

Grass-land worth 30*s.* per acre of annual rent may be supposed to yield 8 tons of grass per acre per annum: and this may be believed able, by careful consumption, to produce 9 imperial stones of beef; or at 6*d.* per lb. a money value per acre of 18*l.* 18*s.* in six years.

The same land, broken up, would under good management, yield during—

The 1st year	25 cwt. of wheat straw
2nd	24 tons of mangold wurzel
3rd	25 cwt. of wheat straw
4th	18 tons of Swedish turnips
5th	20 cwt. of barley straw
6th	10 tons of clover

Or 52 tons of green food, and 3½ tons of litter, in six years, beside the produce of grain.

Of course it is easy so to state figures as to arrive at any result that may be desired; but in the above I have gone upon what I believe to be reasonable data, viz.—

That 24 or 25 cwt. of hay is a probable produce from land of such value;
That hay is one-fifth or more of the grass from which it is made;
That the growth of aftermath is to the growth up to hay harvest as 1 to 3 on such land.

We know from experience that turnips consumed without any artificial food, as it is called, given with them, will not generally yield more than 1 lb. of beef or mutton for every 150 lbs. of green food; and giving grass credit for a little more nourishment than this, we have assumed that 140 lbs. of it will yield the same meat.[*] On the side of arable land, again, I have stated amounts of produce which from several years' experience I know to be probable.

The 52 tons of green food (supposing the straw to be all used as litter) will on the above datum yield 776 lbs. of beef, and this at 6*d.* per lb. is worth 19*l.* 8*s.*, an amount rather larger than that which was the whole return from the grass, while here we have in addition the produce of three crops of grains. Whether the whole extra expense of this mode of managing the land will be more than paid by this extra produce is hardly within the province of this inquiry.

We may now suppose another case—that of arable land wholly devoted to meat-producing crops, and it may be supposed to yield thus:—

1st year	26 tons of mangold wurzel
2nd	30 cwt. of bean straw, and
	34 bushels of winter beans, harvested in time for rye to be sown, which would yield
3rd	12 tons of green food in the following May, to be succeeded by rape yielding
	16 tons in November
4th	30 cwt. of barley straw, and
	48 bushels of barley
5th	20 tons of Swedish turnips
6th	30 cwt. of pease straw, and
	32 bushels of pease; the land then to be thoroughly tilled for the following mangold crop.

---

[*] The best grazing-land in Lincolnshire we are told on first-rate authority will, under the best circumstances, feed an ox and a sheep from New May-day till Old Michaelmas. The former will gain 20 stone, or 280 lbs., and the latter 10 lbs. a qr., or 40 lbs. in the time. The acre will thus yield 320 lbs. of meat. Its produce of grass may be 16 tons—perhaps more. This is 1 lb. of meat for every cwt. of grass, but we must remember that the grass of such land differs from the average in the quality as well as the quantity of its produce.

Here we have 26 tons of mangold wurzel
12 ,, rye
16 ,, rape
20 ,, turnips

Or in all 74 tons of green food.
And 30 cwt. of bean straw
30 ,, barley
30 ,, pease

Or in all 4½ tons of straw.
And 34 bushels of beans
48 ,, barley
32 ,, pease

Or in all about 3 tons of grain.

The average produce per acre of the different crops is put higher now than before, as every farmer will admit that under such circumstances (all the produce being converted into manure) it ought. Now if an ox consume 1 cwt. of turnips daily, in the above case he will need to eat 5 lbs. of grain and use 8 lbs. of litter daily, in order that all may be finished together. The straw will be little enough, but oxen fattening to 7 cwt. will fare well on the food: they will pay at least 5*s.* a week upon it, *i. e.* 5*s.* for every 7 cwt. of roots and 35 lbs. of grain; and the stock of food would at these rates keep 4 oxen for 50 weeks, yielding a money return of about 50*l.* from the sale of the meat produced. According to this, about 8*l.* 10*s.* per acre is the highest produce of meat from land of the quality named; and whether that, taking the large labour of the crops into account, is a profitable produce does not appear.

But we may suppose a third method of cultivation in which the produce, summer and winter, is fed upon the land by sheep, and the following amount of the several crops may be expected:—

1st year	20 tons of early turnips, followed by rye yielding next May
2nd	12 tons of green food, followed by rape yielding in November 16 tons of rape
3rd	26 tons of mangold wurzel, followed by vetches
4th	16 tons of vetches, consumed in time to sow Italian rye-grass
5th	8 tons of rye-grass, followed by 20 tons of Swedish turnips
6th	20 tons of Belgian carrots.

Here we have a gross produce of 138 tons of green food in six years, which at 1 lb. from every 150 would yield 2060 lbs. of meat, or 51*l.* 10*s.* worth per acre in six years; rather more than in the former case.

The two latter cases are not likely to be generally adopted until long experience shall have determined their profitableness:

and to no subject, we are convinced, could an agricultural experimenter more usefully devote himself than this. If a cultivation of this kind would pay, it would be a source of immense wealth in many parts of Ireland, where waste-land reclamation proceeds so slowly mainly because of the unprofitableness of corn-cultivation under their watery skies. The results of our first estimate, therefore, must be the standard with which to compare the productiveness of grass, and it has been seen that the former, besides the large crops of grain on the arable land, yields more meat than the latter. The conclusion which therefore seems to be unavoidable is, that in cases when equal skill and care have been brought to bear both on arable and pasture farming, the latter might be converted without diminishing, and probably with an increase to the national supply of animal food. What other advantages would follow the breaking up of poor grass-lands have already been considered in this Journal.

Suppose, then, that the land in high fertility, drained, manured, and cultivated as our first section requires, is arable, the question still remains, What crops are to be grown upon it? What rotation of crops will it be most advisable to adopt? Of course the ultimate determination on this point will depend on the consideration of profits to be expected under the existing circumstances of markets, climate, labour, &c. But we may refer to some of the better known successions in use, and discuss their relative merits as meat producers without regard in the mean time to the economics of the question. In the first place, however, it seems proper to remark that not only is a good selection of crops, but a right choice also of the best sorts of each, required. The question is not only in what *crops* shall our fertility be developed, but what *varieties* of each will most successfully exhibit it. We must not only ask whether swedes or mangold-wurzel are the most nourishing per acre, but also whether Skirving's or Matson's kind of the one—the long red or the globe variety of the other—is the best to grow. Two kinds of any crop may make an equal draught upon the fertility of the land, but they may differ very materially in the quantity of *food* they respectively provide; and that of course is the measure of their use to the farmer. Twenty tons of swedish turnips may mean 16 of bulb and 4 of leaf, or 10 of bulb and 10 of leaf; the latter would be equally severe upon the land as the former (probably severer), but the former is by far the more valuable result; and a result of this kind is much more frequently the consequence of habit of growth peculiar to *variety* than of circumstances connected with soil or with climate.

It opens up an extensive subject connected with the one in hand, when we remark that this habit of growth—the distinction of variety or breed—may be conferred upon and rendered permanent in plants just as it has been conferred upon animals. And if there were room, I could name many reasons why the society should bestow equal patronage on the breeding of plants with that of animals: the latter has hitherto engrossed its attention; but the former even more than the latter determines the quantity of meat which land shall produce. It determines the quantity of real food out of which meat is produced, and that is of greater importance than the mere arrangement of the particles on the bodies of animals. A short-horn ox, or a Hereford or Devon, has attained its perfect form in consequence of a long and patient attention by the breeder to the laws of good breeding—laws which it is not mere confidence in the analogies of vegetable and animal existence to say have equal jurisdiction in the vegetable world. For they have in some instances been acted on by growers of plants, and they have been productive of as valuable results here as have been obtained under them by breeders of animals. Mr. Maund, of Bromsgrove, has more than once, by crossing varieties of wheat, obtained a hybrid of greater vigour and more useful growth than either of its parents had exhibited: the cross of the common and swedish turnips has resulted in Dale's valuable hybrid. Gardeners well know the use of hybridising as a source of variety in fruit and flower, and this is not the only art of value which agriculture might, under the influence of its guardian societies, if they would only exert it, be induced to borrow from the horticulturist. Under the present accidental sort of benefit which the facts of this art have hitherto conferred upon the farmer, we can enumerate many useful sorts of well-known crops as their result. Natural hybrids accidentally formed, have been selected by careful observers—when artificial ones of the kind required might have been created. But even this less valuable use of hybridising has been of great service: it has given rise to our best varieties of turnip, rye-grass, tare, and even of wheat, oats, barley, &c. Messrs. Laing, Lawson, Matson, and Skirving, and others, have sent out well-marked varieties of swedish turnips selected from natural hybrids, and propagated with care and intelligence. Messrs. Rodwell and Dickenson have in like manner selected natural hybrids of Italian rye-grass. To Mr. Sherriff, late of Mungoswells, in East Lothian, we owe remarkably vigorous descriptions of the vetch and the oat; and all these plants deserve a more particular notice of their qualities as developers of fertility than either our room or our acquaintance with them permits. My experience among swedish turnips is, that Laing's is the neatest grower of any, and one which on very rich land I should choose;—that Matson's, with its remarkably small head, and as being the least likely to run to seed, is the best for early sowing;—that Skirving's yields the heaviest crop per acre, but that its somewhat coarse head renders it more liable to run to seed if early sown; and that perhaps the Fettercairn, a Scottish swede, is among the best as regards the quality of its flesh. I have nothing to add on varieties of the vetch, of grass, or clover. On mangold wurzel I recommend the globe variety as retaining its juices till a later period in the spring than the long red variety, and as being, on that account, preferred by the cattle. A trial of their relative productiveness too was favourable to the former. I have also little to say on the relative nutritiveness of the different cattle crops. There is this difficulty connected with experiments on this subject—that contemporaneous trials of the different kinds can, alone, on the ground of circumstances being then common to all, be admitted as of authority; and yet contemporaneous trials cannot be admitted at all, because at no *one* time are any two kinds of crop equally *ripe*, so to speak, for use. The common turnip should be used in early winter—the swedish in early spring—and the mangold wurzel should not be consumed till March and April. If the two last kinds be tried together in December, it would not be fair to the latter, which would be still too juicy; if, in March, it would not be fair to the former, which would by that time have lost its juices. Lord Spencer found that the mangold wurzel was more productive of beef than the swedish turnip, per ton; but his experience, we imagine, has not been generally realised: most farmers I think agree, that there is no better food for cattle than a good swede, and that it is better per ton than mangold wurzel: though as not being so productive in South England, it certainly is not so good per *acre*. Rape, again, is another crop of most variable value. In the fen district it is considered the most valuable of all the green crops, and certainly nothing can exceed the rich crisp and juicy substance of the stem of that plant grown there; but on sandy soils of less luxuriant fertility it is far from being equal to the swede. Among other crops that deserve more extensive cultivation, kohl rabi, and some of the varieties of field cabbage which yield enormous bulks of food in rich soils, may be named. The Jerusalem artichoke, too, has been recommended for trial: and it is especially proper for cultivation in the case of corners and out of the way places inconvenient for ordinary plough culture.*

I fear that no sufficient trials of the relative nutritiveness of

---

* It can also be grown with little or no manure, and may be allowed to remain in the ground, without danger to the crop, during the greater part of winter. In the feeding of cows, the bulb not only increases the quantity of milk as much as turnips, but has the advantage of improving the quality, instead of giving it the unpleasant flavour imparted by that root. It is planted in the same manner as potatoes.—F. Burke.

our cattle crops have yet been made even to the extent that was possible: at least we know of none; and having but little personal experience of the subject, at least of any definite kind, we are forced to fall back upon the analyses of chemists; and the following table, taken from Professor Johnstone's work, exhibiting the quantity of solid matter per cent. of the crops named will be held by many to be instructive on this subject.

Authorities.	Varieties of Turnip.					Mangold Wurzel.			Beet.		Carrots.		
	White.	Yellow.	Purple.	Kohl rabi.	Red.	Long Red.	Red Globe.	Yellow Globe.	Red.	Sugar.	Red.	White.	Cabbage.
Einhof	8	12½	..	14	..	..	..	..	..	..	14	..	..
Playfair	13	15	..	..	..	..	..	..	..	..	..	13	..
Hermbstädt	21	20	..	22	..	..	..	..	..	..	20	..	..
Horsford	..	17	..	12	18½	..	..	..	18	..	14	..	..
Johnstone	..	11	11	..	..	15	15	14	young		13	..	..
	..	12	12						..	..	20	20	8
Payen	..	..	..	..	..	..	..	..	..	15	..	..	..

There is difference enough among authorities here to make reliance upon any particular set of figures a very difficult thing; the probability, and, indeed, in reference to some of the crops, the certainty is, that individual specimens vary too much in the quantity of water they contain to allow *one* set of results to stand as the representative of a crop. There is great difference too in the composition of the dry solid matter these roots contain. Some of them have a larger proportion of fatty substances, or a larger quantity of the flesh-forming principle than others; but I prefer on this subject to abide by the experience, imperfectly ascertained as it is, of the farmer, rather than by the doubtful* figures of the chemical analyst. We may prefer a ton of swedes to one of mangold wurzel, notwithstanding the enormous superiority of the latter, according to the chemist; and we may prefer the orange globe to the long red beet, notwithstanding that the specimen of the latter, hitherto examined, appears to have contained a smaller proportion of water. For this reason I do not further extract from Professor Johnstone on the composition of the other cattle crops; but I must not forget to remind the reader that the one given above professes to state the relative value per ton, not per acre, on which of course the farmer's opinion must depend. The

---

* "Doubtful" in respect that, however accurately true of the individual, they can rarely be held true of the species or genus.

variable and unforeseeable sources of error in agricultural estimates, still so far exceed in their effect the decimal differences of which the chemist professes to take account, that the latter often are hardly of that importance to the indication of results which some would attach to them. The quantity of protein compounds or flesh-forming matter in a plant may not be so influential on the quantity of meat it produces, as is the indefinable influence of the breed and constitution of the animal which feeds upon it; and I therefore abandon an unsuccessful attempt to determine the relative value of the different green crops as food for the more promising one, to ascertain the relative merits of our rotations by comparing the weight per acre of green food produced by each.

a The first, the Norfolk or four-course rotation, may be supposed able to yield in the

First year, 25 cwt. of wheat straw per acre.
Second year, 19 tons of Swedish turnips.
Third ,, 20 cwt. of barley straw.
Fourth ,, 11 tons of clover and grass.

This is equal to 30 tons of green food in four years, or 7½ tons per acre per annum, a quantity which, at the rate of one for every 150 lbs., is able to produce about 1 cwt. of beef per annum.

b In the second, when this rotation is extended one year by keeping the grass down two years, we may suppose a somewhat larger acreable produce of green crop. Thus—

First year, 25 cwt. of wheat straw.
Second year, 20 tons of swedes.
Third ,, 20 cwt. of barley straw.
Fourth ,, 11 tons of clover.
Fifth ,, 7 tons of clover.

Giving 38 tons as the produce of five years, or nearly the same acreable produce per annnm as in the former case.

c We now may take the Dunbar six years' course of crops as our third rotation, and here we may expect

First year, 20 tons of Swedes.
Second year, 20 cwt. of barley straw.
Third ,, 12 tons of clover.
Fourth ,, 25 cwt. of wheat straw.
Fifth ,, 25 cwt. of bean straw.
Sixth ,, 25 cwt. of wheat straw—

which will yield 32 tons of green food, or 478 lbs. of meat per acre in 6 years, a quantity equal to about 80 lbs. per acre per annum.

d In our fourth instance we take the eight years' course followed on the farm from which we write. It may produce

First year, 25 cwt. of wheat straw.
Second year, 25 cwt. of bean straw.
Third ,, 25 cwt. of wheat straw.
Fourth ,, 24 tons of mangold wurzel.

Fifth	,,	25 cwt. of wheat straw.
Sixth	,,	12 tons of clover.
Seventh	,,	25 cwt. of wheat straw.
Eighth	,,	20 tons of Swedes—

or, in eight years, 56 tons of green food, corresponding, according to our original datum, to 104 lbs. of meat per acre per annum.

e As regards heavy land rotations of crops, we take the following from Mr. Stace's Essay on that subject in the 4th vol. of the Journal. It will produce probably

First year,		12 tons of vetches and 16 tons of rape and turnips.
Second year,		25 cwt of wheat straw.
Third	,,	12 tons of clover and tares.
Fourth	,,	25 cwt. of wheat straw.
Fifth	,,	25 cwt. of bean straw—

or 40 tons of green food, *i. e.* about 600 lbs. of meat per acre in five years, equal to nearly 120 lbs. per acre annually.

f Our last instance shall be selected from Professor Low's work, where it is praised for its suitability to rich clays. It may yield

First year,		Nothing—summer fallow.
Second year,		25 cwt. of wheat straw.
Third	,,	12 tons of clover.
Fourth	,,	25 cwt. of oat straw.
Fifth	,,	25 cwt. of bean straw.
Sixth	,,	20 cwt. of barley straw.

It thus produces 12 tons of green food in six years, or 30 lbs. of meat per acre per annum.

It is proper to remark that the above estimates are more likely to be relatively than positively true; the datum on which their produce of meat is calculated is, of course, subject to the vicissitudes which affect all agriculture, and stultify all farm estimates: the herd which is to convert this food may be carried off by disease, and its produce of meat will then of course be anything rather than 1-150th the weight of the food. But all the rotations named are liable to this risk alike, and it may therefore be useful to compare them :—

Name.		Period.	Lbs. of meat produced per acre per ann.
a	Norfolk . . .	4 years	110
b	Ditto . . .	5 ,,	110
c	Dunbar . . .	6 ,,	80
d	—— . . .	8 ,,	104
e	Stace . . .	5 ,,	120
f	Low	6 ,,	30

Of these the 5th is less likely to realise its estimate than any of the others, as its large produce depends upon the possibility, on an average number of years, of obtaining 16 tons of rape or turnips on a clay soil after a spring crop of vetches, and this is extremely doubtful. Of the fourth rotation—our own—we would only say that we have grown in the past year 30 acres of clover (15 of them for horses), 30 acres of mangold wurzel, 15 acres of swedes and turnips, 14 acres of carrots and potatoes (of which at least 12 acres have been sold, or eaten by horses), so that on 3-8ths of the farm we have had a produce for consumption of 960 tons of green food; and if *all* had been converted into meat, as it might have been, the produce available for that purpose would have been—

30 acres of clover . .	=	360 tons.
30 ,, mangold wurzel	=	420 ,,
15 ,, swedes .	=	300 ,,
14 ,, carrots, &c. .	=	280 ,,
Total . . .		1360 ,,

The meat made from 960 tons has been as follows:—

	lbs.
70 sheep bought at probably 15 lbs. a qr. are being sold now at 25 lbs. = 70 × 40 . . .	2800
About 160 sheep bought at 13 lbs. a qr. will be sold in April at probably 23 lbs. = 160 × 40 . .	6400
10 oxen weighing 5 cwt. have become 6 cwt. each .	1120
20 oxen weighing 6 cwt. have become 8 cwt. each .	4480
6 cows weighing 5 cwt. have become 7 cwt. each .	1344
Add say 30 cwt. of bacon and pork . . .	3360
Total meat made	19,504

But at least 240*l.* worth of food have been purchased, and if it be supposed to have made its worth of meat, which is by the way a very doubtful thing, then at 6*d.* per lb. we must deduct at least 9504 lbs. from the amount of meat made, leaving 10,000 lbs. as the produce of 960 tons, or about 13000 lbs. as the produce of 1360 tons—the produce, in fact, of a farm of 240 acres. This is only about 60 lbs. of meat per acre; it is only 1 lb. of meat produced by the consumption of about 200 lbs. of green food. It is a result, however, probably as near the truth as we can attain; including the circumstances of illness suffered by stock, and of a deduction of the whole value of cattle-food purchased.

In the sixth rotation named, the small produce of meat illustrates the effect of the naked fallow. I believe that there is no more effectual method of increasing our supplies of animal food than the substitution of a green crop such as the vetch, the cabbage, or the mangold wurzel—all clay soil plants—for the naked fallow. This substitution could be effected without expense, that is at a cost paid for by the additional returns it would produce; a crop of 24 tons per acre once in four or six years would be a clear gain of animal food to the amount of 90 or 60 lbs. respectively per acre annually over those districts which admit of the change.

We have thus to recount, as the conclusions to which the second section of our subject has led, that the substitution of green-cropping for naked fallows would be cheaply productive of meat.

That the rotations in use on arable land vary as much as from $\frac{1}{4}$ of a cwt. to more than 1 cwt. per acre in their produce of meat, and that much therefore may be added to the national supplies by the selection of a good succession of crops.

That the conversion of inferior grass land to arable culture, while it would add largely to the supply of human food in the shape of grain, would also to a small extent probably increase the supply of meat. And among the details of this branch of the subject—not to speak of the effect of mere variety in any one kind of crop—we have seen that the produce of meat depends considerably on a right choice of the plants to be cultivated for food. Thus I advise the trial of the field cabbage and the white carrot—the latter from several years' experience—and on all low-lying lands in south and central England, I confidently recommend the substitution to a large extent of the globe mangold wurzel for the swedish turnip. On the farm here we can grow 30 tons of the former per acre more easily than 20 tons of the latter; and our crop of Belgian carrots is generally heavier than our crop of Swedish turnip.

III. We have now to suppose the case of a thoroughly productive farm, and to consider the most economical method of converting its produce into meat. And I must remark in the outset, that the skill required to produce the crop and that required for its profitable consumption are two very different things. It is for the former that the Scottish farmer is generally held to be distinguished; both are essential to a fully profitable result.

Many questions arise under this head of our inquiry. Thus, we may ask—what sort of animal will most economically convert food, the ox, the sheep, or the hog? and what breed of each, the Shorthorn, Hereford, Devon, or other breed of the first—the Southdown, Leicester, or longwoolled breeds of the second—the Berkshire, Yorkshire, or Essex breed of the third? At what age, too, is any of these breeds most productive of meat? Again, how should the food be given to these animals--cooked or raw—wholly succulent or mixed with dry food—green crop exclusively, or oilcake and farinaceous food as well? Lastly, how are the animals to be treated during the consumption of their food; are they to be sheltered or unsheltered; and if the former, should they be kept in yards, or stalls, or boxes?

The unfortunate thing is, that in agriculture, as in other departments of knowledge, *we can ask a great many more questions than we can answer.* There are many points in farming on which we must be content with the loose average sort of judgment which memory enables an unrecorded experience to pronounce; and indeed, till we have the exact results of very many cases, I must prefer this rough average memory of things to the single instances, on which, if we would affect accuracy, we are at present forced to base our estimates. The few instances in which exact observations have yet been recorded cannot, in so variable a matter as "feeding," be taken as trustworthy guides; and, as published statements on this subject have generally been among the maxima of agricultural truth, as otherwise most probably they would not have been published, they are the less worthy of confidence. No one but the educated man, who has long been a farmer, can be aware of the extremely inexact state of the art, or how few trustworthy facts exist as the groundwork of sound calculation in agriculture. Of course no amount of knowledge would enable a confident estimate in the case of a small farm, because there variations would be sure to occur in successive seasons—one year would be better than another. But when the result of *extensive* operations has to be estimated, the variations of season on the *many* small farms of different soil, which they would then affect, may be supposed to balance one another, and the average of a long and truthful experience would then be most useful. Perhaps all that can be said of this matter, in relation to the manufacture of meat, is that data such as this we do not possess; and thus a writer on this subject can do little more than state impressions and prevailing ideas on the topics which he requires to mention.

1. Our first question is, What sort of animal will most economically convert vegetable produce into meat? A cottager would say, the hog; most farmers will say, the sheep. The decision of the former is perhaps induced by the omnivorous character of the animal, which, where all sorts of waste have to be used, is a most useful quality. I believe that perhaps, if the same price could always be obtained for the carcase of the hog as for that of the sheep or the ox, the first would be the most profitable of the three. There is less waste of food in the growth of offal; the proportion of offal to carcase in a well-bred hog is often not more than as 1 to 2, or one-third of the live weight of the animal; while in the sheep not more than a Smithfield stone of mutton out of every imperial stone of live weight can be calculated on; and in the ox the offal is very often heavier than the carcase.* Another most

---

* In published works the proportion of beef has generally been put much higher:

valuable property of the hog, though hardly connected with this subject, is the rapidity with which it multiplies; and this is apt to bias the judgment in its favour. Certain it is that, however profitable to the cottager as the savings-bank of scraps that would otherwise be lost, the hog has not been found profitable when cultivated as the exclusive consumer of the farm produce. A farm near this was once wholly devoted to the produce of pork and bacon; the full details of its history I have not been able to obtain, but the result is well known, that the farmer lost money by the speculation and soon abandoned it. And the general idea I believe to be that, except for breeding and sale as "stores," hogs on farms should be kept not many more in number than will suffice to consume the "waste."

Of the sheep, by which probably as much as by any other animal the green produce of our arable lands is consumed, I have only to say, that the result of a winter's consumption by a healthy flock of well-bred Cotswolds, folded on 30 acres of Swedish turnips, was the yield of 1 lb. of mutton for every 150 lbs. of the food; a quantity which I believe to be as great, or greater, than is yielded by feeding cattle. And there is this in favour of the impression of the superiority of sheep to oxen as converters of green food into meat, that of about 150 sheep, cross-bred Cotswolds and Downs, weighed alive and sold by weight the winter before last, about $\frac{11\frac{1}{2}}{20}$ of their weight alive* was mutton—a proportion nearly the same as $\frac{8}{14}$, or a Smithfield out of an imperial stone—while of 20 or 30 oxen that we have weighed alive, and as beef, certainly not more than $\frac{10\frac{1}{2}}{20}$ has been carcase.

The *profit* of feeding is certainly no index to its *produce*, which alone, it would seem, is the subject proposed by the Society; and therefore, however satisfactorily the following figures show that great averages by no means resemble the maxima of the items out of which they arise, we do not lay any great stress upon them as answering the question we are now considering. They are extracts from the annual balance-sheet during the past four years† of this farm, where the system adopted has been exclusively the purchase of cattle and sheep, feeding and selling them.

---

and there is no doubt that in very fat animals the proportion of offal is smaller. But so far as our experience goes of beef in the condition in which butchers on the average buy, not more than 55 per cent. of the live weight is carcase; and this has been in the case of a good breed.

* The wool was heavy upon them at the time, which would diminish the *proportion* of meat to weight.

† Shillings and pence omitted.

DATE.	OXEN.		SHEEP.		SWINE.	
Year ending 6th April.	Cost.	Receipts.	Cost.	Receipts.	Cost.	Receipts.
	£	£	£	£	£	£
1845 . . .	642	672	467	579	121	158
1846 . . .	564	758	961	1024	121	209
1847 . . .	643	693	627	583	197	282
1848 . . .	1067	1115	421	393	312	355
Total . . .	2916	3238	2476	2579	751	1004

There was thus on the whole four years a profit on the

Oxen	of 322*l.*	on a	cost of	2916*l.* or 11	per cent.
Sheep	103*l.*	,,	,,	2476*l.* or 4½	,,
Pigs	253*l.*	,,	,,	751*l.* or 33	,,

Do not let me be mistaken however: these sums are not net-profit. It is merely the cost of purchase, of attendance, and of bought food (a very large item), with which these accounts are debited: the expense of cultivating the green crops on which the animals were fed has not been charged on them at all; had that been accounted for here, a great apparent loss would have been exhibited instead of this apparent profit; a loss, however, probably balanced by the value of the manure of which a great deal of excellent quality is made from animals so highly fed. And, neither must the proportionate nominal profit be taken accurately to represent the merits of the different kinds of stock as meat producers; for independently of the fact that profit and produce have rarely any direct proportion, I am by no means confident that each kind of stock was debited with the actual proportion of purchased food it consumed; so that all I can possibly vouch for is that the gross result is accurate; namely, a profit, excluding the cost of home-grown food, of 678*l.* on a cost of 6143*l.*, that is of about 10½ per cent. on the outlay. Supposing during the four years our annual consumption of the farm produce in green crops to have been 1000 tons, then this 678*l.* is all that we have got for 4000 tons of green food. This is about 3*s.* 4*d.* per ton—a result singularly similar to some other tolerably extensive and very trustworthy specimens of experience given hereafter.

I confess the extremely unsatisfactory character of the answer to the first question that was put—what animals make the most meat out of their food? but I imagine that their respective growths of offal and rapidity of return must furnish the best reply; and if so, the hog must be placed first in merit, then the sheep, and lastly the ox.

2. All the carcase is not meat; and some breeds of the hog, the sheep, and the ox respectively are more remarkable for fineness of bone and lightness of offal—from being of larger growth in their best parts and of smaller growth where the meat is coarse—than others. And thus the next question is, what breed is best to adopt. But this is a question to which, if it be put to agriculturists generally, no one need ever expect to receive a unanimous answer. The circumstances of localities differ so much, and the habits and constitutions of animals are so variable, that a variety of breeds will, and indeed *should*, always exist.

The Cheviot sheep and the blackfaced will retain their position on their hills and heaths, however superior to them the Leicester, or Cotswold, or Down may be either in carcase or wool: these breeds could not live under the exposure which those must bear. And so with cattle—the Kylo and the Galloway will still be bred notwithstanding the superiority of the short-horn and Hereford. And when meat is not the exclusive, nor even the main produce of a breed, other reasons for maintaining existing varieties come in to complicate the matter. The Ayrshire breed and the Jersey are not likely to be dispossessed of their respective localities, however suitable the better breeds of Durham and North Devon may be for the agriculture there: their character as milkers saves them.

There seems to be less reason for maintaining the existing varieties of the hog; for this animal is kept so much in shelter that any climate would suit any sort; but even here we need large breeds and small breeds to meet the market, and to suit the calls respectively for bacon and for pork.

The answer to the question about breeds, if any be attempted, is thus not likely to satisfy either our readers or truth itself. For our own locality we have no hesitation in choosing the Hereford ox, the cross-bred (Down and Cotswold) sheep, and the Berkshire hog; but I do not pretend to dictate this as a right decision for all localities. Farther north one would probably prefer a short-horn and a Leicester, and farther south a Devon and a Down, simply because there it would be easier to procure good individuals of these breeds respectively, our plan having been to purchase our fattening animals, not to breed them.

But to be more particular:—I have been unable to discover any exact information on the relative merits of the different breeds of the hog, as meat-makers; and all I can say on this point is, that taking all the circumstances of rapid growth, constitution, and lightness of offal, it is a general idea that a well-bred Berkshire hog is as likely as any other variety to manufacture food into pork or bacon with economy.

Regarding sheep there certainly is more information, but not so conclusive, as to silence those against whose interests it may lie. We may probably state as its result that a well-bred Leicester sheep carries more meat in proportion to offal than any other breed; and a well-bred South Down more than individuals of other short-woolled varieties. The relative precocity, or early maturity of these breeds stands also probably pretty much in the same order. The question regarding offal is, however, to be answered satisfactorily, only by a long series of facts regarding animals of either sex, of all ages and condition; for certainly a fat animal carries less offal proportionally than one but half fat; and to compare a fat Leicester with a fleshy South Down cannot be a fair thing. But we do not possess detailed information on this subject; perhaps as good a single set of facts connected with it as we possess is that furnished by Mr. Moore of Coleshill, in the 7th volume of the Journal. The experiment included four breeds of sheep—the Leicester, Down, Cotswold, and half-bred (Down and Cotswold); but I do not quote the results, because even here the trial was of only three or five on either side, a number which cannot be held sufficient to decide the question.

Of oxen we may remark that in a very full and instructive paper on the carcase weight of cattle, in a monthly periodical called 'The Plough,' the breeds are placed in the following order as to proportionate lightness of offal:—

1. Durham, Shorthorn, Hereford, Sussex, Devon.
2. Craven, Lancashire, &c., Galloway, Suffolk, &c.
3. Argyleshire, Kylo, &c.

There is no doubt that the Short-horn, Hereford, and Devon oxen are the most economical beef-makers we have. The question remains, which of them is the best in this respect? and we have no exact answer to give it. But just to show the bearing of breeds on their relative manufacture of offal and meat respectively, out of food we may give the following figures, calculated from Mr. Ewart's data in the paper alluded to. A short-horn ox (prime fat) of 70 stones carcase weight must, according to his estimation, have weighed 111 stones alive:—

	st.	lbs.
It yielded beef of 1st quality . .	19	8
,, ,, 2nd ,, . .	22	10
,, ,, 3rd ,, . .	27	10
	70	0

A Kylo of 40 stones carcase weight must in like manner have weighed 71 stones alive.

	st.	lbs.
It yielded beef of 1st quality . .	11	0
,, ,, 2nd ,, . .	13	6
,, ,, 3rd ,, . .	15	8
	40	0

Or on the whole live weight, all of which of course in each case was made out of the food consumed, the *per centage* of offal and of the different qualities of meat is as follows:—

	Shorthorn.		Kylo.	
	st.	lbs.	st.	lbs.
1st quality	17	6	15	12
2nd ,,	20	4	18	8
3rd ,,	25	4	21	8
Total meat	63	0	56	0
Offal	37	0	44	0
	100	0	100	0

So that in the former case 37 only, while in the latter 44 per cent. of the food consumed has, so to speak, gone to waste.

But no merely proportionate account of this matter can present the whole truth. A quantitative statement is required. In the one case we have 70 stones of beef and in the other 40. What if as much food has been consumed in the manufacture of the latter as of the former? It is not in the mere relation between the live and carcase weight of cattle of the different breeds that their relative merits lie when the national supply of meat is under consideration. It is not so much the circumstance that this animal lays little meat on the coarsest joints and carries flesh most on the best parts, though that is of importance, but it is because out of *this* quantity of food it has in so short a time acquired *such* a weight that its possession is of value to either producer or consumer. The great national benefit which our breeders of cattle and sheep have conferred lies in the earlier maturity as well as the better form that they have communicated. An ox did not use to reach maturity till its fourth, nor a sheep till its third year; now, thanks to the skill and perseverance of Collins and Bakewell, and Tomkins and others—we have fat beef of two years, and fat mutton of fourteen months of age. A farm may have produced a maximum of food for animals during the last century; but its produce of meat could not have equalled what it now is, because the same herd which it then turned out fattened once in four years is now sent to market once in every two years; and the same flock which was fed and sold once in three years is now converted into mutton every fourteen months. This, it must be confessed, illustrates the *fact* that the choice of breed does greatly affect the produce of meat, rather than the *question*,—Which is the best to choose? But in the absence of more satisfactory information on this branch of our subject we must pass on to the next.

3. The third question that is asked is,—What kinds of food are to be given to cattle, and in what condition are they to be administered?

Many, perhaps most, sheep and cattle are fed and fattened on grass alone or on turnips and other green food, with at best a little hay. In Scotland, where a turnip is a very different thing from that which it is in England, cattle may be, and to some extent are, fattened on turnips and straw. In England and in Scotland too, however, it is now more generally the custom to use oil-cake and other nutritive food in the process. In Lincolnshire large quantities of this linseed-cake are consumed every winter in the straw-yards: and the farmer is repaid for his outlay in this respect by the production of a large quantity of valuable manure. Of course the value of this manure as a fertiliser depends upon the quality of the food from which it is made, as well as on that of the other products of its consumption; oil-cake *minus* the growth of a growing animal, which is *its* manure in such a case, is a much better thing than mere straw *minus* the same, which would be the manure of a young animal fed on straw alone. The former contains various nitrogenous and mineral substances useful as food for plants, of which the latter is almost destitute. And so, by the way, is the manure made by a fattening animal better than that made by a growing one feeding on the same food; just, indeed, in the proportion in which the mere extraction of fat, which is nearly all the growth in the one case, would leave a better remainder than the subtraction of flesh and bones from the food, which is the growth, in the other. But this is a digression.

More lately the eyes of farmers have opened to the real composition of the oil-cake, as it is purchased either from home or foreign makers. It is found in many cases to be very much adulterated with all sorts of seed and rubbish; and, in good measure owing to the exertions of Mr. Warnes, of Trimmingham, in Norfolk, the method has latterly prevailed of giving animals whole linseed (not the mere husk, which is all that oil-cake at its best contains), and along with it of adding to the straw chaff in which it is conveyed to the animals, some farinaceous substance, as Indian corn, barley or bean meal. The question whether it is profitable thus to consume these concentrated sorts of food in feeding stock, depends altogether on the kind of animals that are fed. A sheep or ox which will not waste its food either in growing offal or in tedious growth, will convert that profitably which on an animal of coarser build and less thrifty growth would be thrown away. The latter would lose more of their food than the advantage of the proportion they managed to assimilate would repay; and thus the only question to determine is, what degree of nutritiveness is it most profitable to confer on the food given? The use of this better food is perfectly economical even with a poor stock, provided it be used only to raise what of the farm produce may be below the standard of quality which this question indicates. With poor stock I have used linseed with profit. A thin linseed soup poured over straw chaff will confer a savoury taste, even though it be so diluted as to leave the food thus prepared of less nutritive strength than the ordinary green food of the farm; and there is perhaps no better door open to an increased produce of meat for the country at large than means such as this afford of inducing the larger consumption of what is now trodden under foot. A salt, hot, and weak linseed soup thrown over straw chaff, while conferring its own flavour, brings out that of the straw, which is thus far more readily consumed than the mere addition of oil-cake is likely to make it. This fact is submitted to those who are in the habit of using such large quantities of oil-cake as cattle food. We have kept oxen through winter in a rapidly improving condition* on turnip-tops at the commencement, and half a cwt. of turnips daily a-piece afterwards, along with an *ad lib.* allowance of straw chaff, over which about half a pailful of salt water, for each beast, containing 1 lb. of linseed meal boiled in it, had been thrown.

Of course a more intensive system of feeding is profitable in the case of well-bred animals. Many instances of this are scattered about in agricultural publications, but they illustrate the possibility rather than prove the truth of our statement. They are not numerous enough, nor various enough, to show that the average experience of farmers bears us out; but I may specify one or two cases as illustrations, and for the rest appeal to the common impression which *has* arisen, however carelessly, out of experience, to corroborate the assertion that high feeding, by its greater produce of valuable manure, is profitable to the farmer; and in the case of well-bred animals, by its greater produce of meat, is profitable even to the feeder. The following is a bit of our own experience during the past winter:—Four good Hereford oxen were bought towards the end of October for 60*l.* at a dear market, and sold again in thirteen weeks at 6*d.* per lb., for 77*l.* These four oxen, in thirteen weeks, gained 17*l.*, or 26*s.* per week, or 6*s.* 6*d.* per ox per week. They consumed during that time 18 tons of mangold wurzel, 30 bushels of beans, and 4 cwt. of linseed meal, for which, besides the manure, we have thus obtained the following prices:—

4 cwt. linseed, or more than 1 lb. daily per ox, at 11*s.* .	£2	4
30 bush. beans, or nearly 5 lb. daily per ox, at 4*s.* 6*d.* .	6	15
18 tons of mangold wurzel, or 1 cwt. daily per ox, at 9*s.*	8	2
	£17	1

---

* At a cost of for turnips (at 10*s.* a ton) 3*d.* daily
„ „ linseed . . 1*d.* „
4*d.* a-day
Or 2*s.* 4*d.* a-week, beside fuel, attendance, and straw.

This has paid well; but though one of the oxen was ill for a fortnight, and lost flesh by its illness, I have no hesitation in saying that the result is far beyond the average truth in such matters.

Again, to add a case of older date, but well authenticated by the names of living farmers. In 1835, Mr. Brodie and another East-Lothian farmer communicated the results of a trial they had made on this subject to the Agricultural Society of that county. The whole report will be found in the 16th annual statement of that Association. Its results are given in the following Tables:—

1. Mr. Brodie's experiment on four lots of seven Durham oxen:—

No.	Original Value, Oct. 19.	Valuation April 1.	Increase.	CONSUMPTION.	
	£.	£. s.	£. s.		£. s.
1.	95	150 10	55 10	96 tons turnips at 11*s*. 6*d*. per ton . .	55 10
2.	95	157 10	62 10	58 tons turnips at 11*s*. 6*d*., and 16 tons potatoes at 35*s*. 10*d*. per ton . . .	62 10
3.	95	175 0	80 0	93 tons turnips at 11*s*. 6*d*., and 23 tons 5 cwt. 56 lbs. cake at £11 13*s*—£3 over cost price	80 0
4.	95	147 0	52 0	115 qrs. draff at 4*s*., 83 puncheons of dreg at 2*s*., cartage £9, 4 qrs. peas 42*s*., 13 qrs. oats 28*s*. bruising, &c. .	52 0

Here, so high a price was obtained for the turnips, and yet the oil-cake was more than refunded by the value of meat obtained. In the second case the potatoes did not repay their consumption. In the fourth, the distillery refuse and peas seem to have just paid their account. Draff is the spent malt and dreg the liquor after the spirit has been distilled from it.

2. The other experiment on four lots of five oxen:—

No.	Value Nov. 10.	Valuation Mar. 24.	Increase.	CONSUMPTION.	
	£.	£.	£.		£.
1.	35	61	26	3½ acres turnips at £7. 8*s*.	26
2.	35	68	33	1¾ acre turnips at £7. 8*s*., 1⅓ acre potatoes at £15	33
3.	35	74	39	1¾ acre turnips at £7. 8*s*., 59 bushels bran at 8*s*. 9*d*.—double the value .	39
4.	35	70	35	Potatoes as No. 2, 59 bushels bran at 5*s*. 1*d*.	35

Here again the best result was obtained where the most nourishing food was given, and it was again shown that potatoes (supposing them to be an ordinary crop) are valued too highly for feeding purposes at 15*l.* per acre.

The method of feeding adopted in the case of our four Hereford oxen was the same as we have for the last few years adopted with all our cattle and sheep. Each sheep gets about one-eighth the quantity given to an ox, with about 20 lbs. of swedes daily in the beginning of winter, or of mangold wurzel in the spring. The same method is adopted with cattle during summer: they are fed on the linseed compound along with cut clover or vetches *ad lib.* The following is our present arrangement, in which, simply owing to the proportion of the stock of food on hand, our proportion of linseed-meal and bean and other meal varies from it much. Every day—40 lbs. of linseed are boiled in 70 gallons of water, and thrown over 44 heaped bushel baskets full of chaff, on which again 250 lbs. of bean and other meal are dusted. Of this the sheep (200) get 16 baskets, *i. e.* about 15 lbs. of linseed and 90 lbs. of meal, equal to 1¼ oz. of linseed and nearly ½ lb. of meal daily apiece; and the cattle (30) get 24 baskets, *i. e.* 22 lbs. of linseed and 135 lbs. of meal, equal to about 12 oz. of linseed and 4½ lbs. of meal each daily. The rest is given to horses. I might give other instances of the profit of feeding cattle on purchased food, and of the greater economy of home-made food compared with the oil-cake which is generally used. Mr. Warnes' own published experience has furnished instances; and the following is a case which he quotes:—

Mr. Postle, of Smallborough, Norfolk, tried the merits of oil-cake against those of linseed and peas. He found that six cattle consumed 20*l.* 6*s.* 1½*d.* in linseed, peas, fuel, and labour, besides the swedes and hay they received; and that the other six consumed 21*l.* 14*s.* 9*d.* in linseed cake, besides an equal quantity of grown food and hay. The former lot, though apparently of only equal weight and quality with the latter at the commencement of the experiment, had gained by the close of it, during a period of six months, about 45 stones of beef more than the other. And this advantage on the part of linseed and meal over oil-cake holds good in the case of sheep as well as cattle. Mr. Bruce, of Waughton, in a report communicated to the Highland Society in 1844, gave the result of an experiment on this point, in which lots of twenty sheep each were fed variously and tried against one another for a considerable period, and the increase of each being compared with the food consumed, it was found that to every pound of increased weight in one case, there had been a consumption of 101 oz. of linseed-cake; and to every pound of increased weight in another, there had been a consumption of 59 oz. of linseed and beans (mixed 1 to 6); and to every pound of increased weight in a third, there had been a consumption of 56½ oz. of linseed and beans (mixed in the proportion of 3 and 2); while in a fourth instance, the same growth had been effected during the consumption of only 46 oz. of linseed by itself. It appears, therefore, that it is economical to use linseed whole rather than the mere husks of it which we obtain in oil-cake.* In all the former cases it was ground to meal and boiled in water enough to make a mucilage, and then thrown over chaff enough to make nearly a bushel of the porridge to every beast, the bran and other meal being first dusted over the whole and incorporated with it. In the last the linseed was given to the sheep whole, and they ate it out of troughs as they ate the oil-cake. Mr. Warnes has latterly recommended the linseed *to be given in a cold mucilage, which can be obtained at less cost by the mere soaking of the meal in cold water for a day and a half.* One measure of linseed meal is to be placed in 7 measures of water stirred up and allowed to stand; it will form a jelly in about 30 hours, and may then be thrown over chaff, and used with other meal just as the hot solution is: cattle, it is said, are found to do as well on the cold as on the warm food. I have no experience to offer on this assertion, but I should doubt it.

---

* I extract a passage on this subject by Mr. Valentine, of Leighton Buzzard, in the 'Agricultural Gazette.' He says:—"Our fatting cattle still continue to thrive very fast upon the prepared food. We weighed a quantity of meal, hay, and turnips, and by this means ascertained the cost per head over a lot of 28. The meal is a mixture of linseed, lentils, and barley, in about equal proportions, and costs, including grinding, 1*d.* per lb. The hay consumed on the ground where it was grown we value at 2*l.* per ton; the turnips we value at 7*d.* per cwt., or about 11*s.* 8*d.* per ton. The following account will therefore show the cost of each beast per week:—

	s.	*d.*
"5¾ lbs. meal per day, at 1*d.* per lb., or 40 lbs. per week	3	4
"56 lbs. turnips per day for seven days, at 7*d.* per cwt.	2	0½
"20 lbs. hay chaff per day, or 140 lbs. per week, at 2*s.* per cwt. . .	2	6
"Cost of food per week	7	10½
"Attendance and interest upon capital employed, about 1*d.* per week .	0	1
"Total cost	7	11½

"The system of preparing and giving the food is nearly similar to Mr. Warnes's, and need not be repeated here. Butchers who have inspected our stock annually, and previous to the adoption of feeding on prepared food, confidently assert that the beasts thrive faster now than before. We are quite satisfied that this is the case, and ought not to omit to state that the unprepared food cost from 12*s.* to even 16*s.* per week per head, in the years 1845 and 1846. Beasts of equal ages and equal sizes, when tried upon prepared and unprepared food, consumed by far the largest quantity of raw food, without a corresponding increase in size or value. I recently saw some fatting beasts living upon hay and oil-cake, at an expense of 18*s.* per week, and thought such a system enough to ruin a mint. I have no personal interest in recommending the fatting of cattle on prepared food, apart from a desire of diffusing an econominal system of farm management. But should any-one feel desirous of more detail, I shall be happy to furnish it. Butchers have given us 10*s.* per week for allowing half-fed beasts to live on the prepared food, and are satisfied with the proportionate increased value of their animals."

And this leads to the question in what condition should food be offered to cattle. Of summer food, vetches, &c., cut and carried to the house, a somewhat costly experience makes us say that it should be cut and left to wither some hours before use. Green and succulent as the vetch or clover is, they are as often physic as they are food, unless somewhat dried before consumption. Of winter food—turnips and mangold wurzel—I have only to say that they should be used in the order of their ripening. Common turnips first, then the hybrids, then swedes, and lastly mangold wurzel. They are rarely given boiled: Mr. Warnes has recommended them when cut to be laid in a heap or mashed in a cask along with the hot linseed mucilage which he pours over them, so that the whole is warmed; but the few existing experiments on the subject, however favourable to the feeding of pigs on boiled food, have not recommended its use for cattle. Mr. Walker, of Haddington, found five oxen and heifers on steamed turnips, &c., to cost 5*l.* 19*s.* more during the period of the experiment than the same number on food uncooked; and while the latter, after putting a certain value on the food consumed, paid 4*l.* 12*s.* beyond their cost, the former did not repay their expenses, similarly estimated, by about 16*s.* on the lot.

And as regards the condition of the artificial food given to cattle. The Harleston Farmers' Club recommend the boiling of the corn even more than of the linseed with which it is mixed. Our practice has been to boil the linseed merely, and then dust the corn meal over the chaff after the boiling mucilage has been added. And that it is of importance thoroughly to reduce the linseed by grinding, and boil it, and convert it perfectly into a mucilage, is proved by the experiments of Mr. Thompson, of Moat Hall, near York. He found that of 1000 grains of uncrushed linseed, boiled for one hour, 845 were still insoluble, while of the same quantity crushed, and similarly treated, only 525 were insoluble. And, notwithstanding that most of our meat-producing animals chew the cud, it is well to be particular in assisting mastication and digestion by the utmost reduction of their food before it is administered. Turnip-cutters, and chaff-cutters, and corn-crushers, are useful in a meat manufactory, not only by causing the consumption of what would otherwise, to a great extent, be lost, but also by enabling the more perfect exhaustion of the nourishment contained in that which is consumed.

I have said nothing of swine in this part of our subject, but it is well known that they allow of a more concentrated nutritiveness in their food than other animals, so that it is even the practice to give them greaves, and grease, and blood, and other animal matters, which they convert into pork or bacon with a profit.

The following is a case of high feeding with profit in the instance of the hog. Two sows and thirteen pigs were bought for 15*l.*; they consumed 68*l.* worth of Indian corn and barley, both bought at so much as 5*s.* per bushel; they ate the produce of one-eighth of an acre of potatoes, and they had the run of a grass field during the period of feeding; they ultimately yielded 276 score lbs. of bacon, which, selling at 8*s.* 6*d.* per score, realised 115*l.*, or 35*l.* beyond the actual cost of animals and food; a sum which was ample payment for the potatoes and the grass. But every one can find in his experience instances of profitable feeding in the case of the hog, as well as in the case of the other animals also which the farmer fattens. The difficulty is to give only their due importance to detached instances of this kind. The following instances appear to be average truths. They are extracted from the 'Agricultural Gazette' in 1847-8. On a Galloway farm, thirty aged cows and heifers were tied up to feed:—

	£.	*s.*	*d.*
They cost	292	0	0
Were fed 30 weeks. Interest	9	2	0
Attendance	15	0	0
Fuel	4	0	0
Linseed 10 qrs., beans 30 bshls., oats 50 lbs.	40	18	0
Total cost	361	0	0
They were sold for	425	0	0

having consumed 400 tons of swedish turnips, which, at 3*s.* a ton (the price they thus obtained from them), make about 60*l.* the amount they gained. Again, on a north Lincolnshire farm, sixty head of cattle (forty Galloways and twenty shorthorns) were put up to feed:—

	£.	*s.*	*d.*
They cost	905	0	0
Were kept from January till May. Interest	22	10	0
12 tons of oil-cake	138	0	0
5 tons of hay	20	0	9
Attendance	26	0	0
Total cost	£1111	10	0
They were sold for	1197	2	0

having consumed about 580 tons of swedes, which, at nearly 3*s.* per ton, the price their feeding obtained for them, make about 86*l.*, the amount they gained. These prices do not pay for growing these roots; but in the one case 150 tons of good manure were made, and in the other 1300 cubic yards, and it is to this that the farmer looks for repayment of his cost.

There is no truth more unwillingly learned by the amateur, or yet more certainly forced on him in a few years, than the small influence of maxima on agricultural averages; so that the experienced farmer comes to look on all these reports of individual cases with an indifference which might appear unreasonable. It is a hard matter to say what is truth in so variable a matter as feeding; or where it is to be found, if not in the instances whose details are recorded in our agricultural publications. But I believe that average experience concurs in recommending a treatment of fattening animals very much—if profit be our end—in proportion to their quality. Well-bred stock may be forced from calfhood forwards with the highest feeding from beginning to end; its precocity will take every advantage of every aid to development: but coarse unthrifty animals will pay for little beyond a self-obtained livelihood from poor pasturage, where there is no labour, little rent, and nothing bought to swell the debit side of its account. And between these extremes of course every variety of treatment may be demanded by varying circumstances. If high feeding be adopted, the object should be to give, in the most digestible form—cut or crushed or even boiled, and intermingled—food combining nourishment and cost in the most economical proportion. Linseed, as a source of the fat, and pease or bean meal, as a flesh-forming food, seem to offer the best mixture. This, with Swedish turnips and mangold wurzel to furnish water enough—not to speak of their own really nutritive quality—and hay and straw chaff to give the bulk without which the stomach cannot rightly perform its functions, and salt as a wholesome condiment, will fatten an ox or a sheep as fast as other circumstances permit.

4. What these other circumstances are we must now consider. They are all included in the words health, warmth, comfort.

I do not intend to discuss methods of restoring health when it has once been disturbed. It is very seldom that a veterinary surgeon can make much good of a fat patient. The best plan is to kill such an animal on the first symptom of anything serious, and sell the carcase. But it is with comfort and warmth as the *preventives* of illness that we have to do. I shall not quote at any length the explanations of the chemist on the advantages of warmth. No one doubts these advantages. The fact is, that the quantity of food which is consumed—*i. e.* burned—in the body for the maintenance of its heat depends on the weight of the air drawn into the lungs. If an animal be artificially warmed it neither will nor can inspire so much as if it were cold. There is not so much loss of heat to restore, and less fuel burned will maintain it; and the animal, not needing so much air to burn that fuel, will not draw so much into its lungs. But it could not if it would; for assuming that an equal bulk of air is breathed one day with another, the warmer it is the rarer and less heavy it will be; so that the artificial circumstances which induce external warmth hinder the animal from making so much use of the means which have been provided for the natural maintenance of its temperature. The warmer, therefore, in reason, that an animal is kept the less of its food goes to waste as fuel. But it is not merely cold that an exposed animal has to sustain. A flock of sheep folded on the turnip-fields, as they often are, amidst frosts and snows and rain and wind and sleet, are in as miserable a plight for making mutton as can be conceived. And it is by the avoidance of all the stagnation and disease consequent on this, as well as by the direct saving of food which warmth effects, that shed-feeding recommends itself. Mr. Childers first proved and published the benefits of the plan in the case of sheep to British farmers; but it had long been known on the Continent.* The Society's Journal contains several cases of the advantages attending this mode of treating them. And Mr. Huxtable has latterly recommended a still more artificial treatment, of which we have as yet had no experience. He advises, in order to save straw as food, and to obtain manure in a state to drill, that sheep be kept without litter on a sparred floor, through which their dung may drop into a pit below. Of shed-feeding sheep we have had several years' experience over, in the whole, nearly 1500 fattening sheep; and the plan, so far as yet appears, we shall continue to follow. Our balance of accounts, published in a past page, may not appear to speak well for the plan; but it is not out of this we are persuaded that the small returns from our sheep have arisen. It is the great expense of feeding them that has reduced our apparent profits. We have had this winter 230 heavy sheep in sheds, their litter and manure accumulating under them for three months together. The shed does not cover the whole of the space on which the animals stand. Every eight sheep have a pen of 10 feet by 15 feet, and of this a roof covers about 10 feet by 10 feet. Not a single case of lameness has attended our flock this winter, and they have been growing fast.† They eat their food (7 lbs. turnips at 6 A.M., linseed porridge at 10 A.M., 6 lbs. turnips at 2 P.M., and 7 lbs. turnips in the evening) and lie down the rest of the day. To this continual rest we attribute their

---

* Having farmed, largely, many years ago, on the shores of the Baltic, I was compelled to keep the sheep under sheds to guard them, during the winter, from the attacks of wolves. At first they were housed in an enormous barn; but, afterwards, in covered sheds, in which they were found more healthy, and I could not perceive any advantage in the greater warmth of the barn than of the sheds in respect of their fattening.—F. BURKE.

† The feet of about two pens of sheep are pared every day, so that the shepherd gets over the lot every fortnight.

tendency to disease of the bladder, which certainly is somewhat remarkable: but upon the whole we do not hesitate to recommend shed-feeding of sheep as, other things being equal, the healthiest and fastest method of making mutton.* Whether it be the fastest way of making *money* is another thing: the modes of feeding come in for consideration then, as well as the cost of carrying food and manure.

I have nothing to say on the hog in this part of the subject. He has always received more care than the other stock of the farmer; and a warm, clean, and well-littered sty is as good an apartment to live in as any fattening animal can desire.

Of the ox there is more to say. I shall not refer to summer grazing, because that is so thoroughly inartificial a method of management. But as regards the winter feeding of cattle there is a choice of methods requiring discussion. Oxen, when fattening, are sometimes kept in large yards, 10 or 12 together; or, as in East Lothian and other counties, in hemels—small yards containing about two feeding cattle each; or, as is a still more general practice, in stalls, each tied by the neck to a trough, and having a width of about 5 feet on which to stand or lie; or, as has latterly come to prevail, in covered boxes, as they are called—that is, in railed divisions, one ox in each, under a roof—the litter and manure being allowed to accumulate under them from one month to another.

The first plan is clearly inferior to the others. The hemel system has been experimentally compared with the stall feeding by Mr. Boswell, of Balmuto, in Fifeshire. He found that 4 3-year old cattle, and 4 2-year olds, in hemels, gained from 17th October, 1834, to 19th February, 1835, 23 stones 1 lb. of meat more than the same number of similar animals fed on similar food in stalls. But this was not all profit, for the former consumed more turnips than the latter by about 3½ tons. The gain of 23 stones of meat was accompanied with a greater consumption of 3½ tons of green food.

I have not met with any other instance of exact experiment on this subject; but this one seems to indicate very clearly the advantage of giving the animals more exercise than they can take when tied by the neck. And I have no hesitation in recommending—from 4 years' experience of above 160 head of feeding cattle—box-feeding, as combining the complete shelter and the comparative freedom characteristic respectively of stall and hemel feeding. In a box about 10 feet square, an ox will need about 15 to 20 lbs. of straw daily as litter. The dung and soiled litter

---

* It may be well just to mention that Lord Talbot and Sir R. Simeon, of the Isle of Wight, have adopted a plan of stall-feeding sheep, of which they speak highly, but the expense of which is we fear too great for an economical manufacture of mutton.

are allowed to accumulate for months together. The trough should be moveable, so as to be raised as the animal rises in his lair. The advantages are, that under these circumstances none of the liquid manure is lost, and the animals are *dry*, and *clean*, and *warm*, and the air they breathe is *sweet*. There has been a good deal of opposition to the system of box-feeding in the agricultural periodicals of late; but it certainly has been an unreasonable opposition. What though the tendency of manure when it accumulates is to ferment, and generate nauseous gases? What though these gases be injurious to animal health, and though an ox cannot lie down daily amid its own excrement without injury?—All this I most readily admit; and yet the *fact* remains unassailed, that a box-fed ox, properly littered, will allow its litter and manure to accumulate under it, and maintain notwithstanding a dry and clean coat, and a healthy growth. The fact is, that under his weight the manure does not ferment in any mischievous degree; the straw does not rot. The fact is, that he can choose his bed; while a stall-fed animal lies where he stands whatever be under him. The fact is, that the former has twice the space to live in that the latter has: and the FACT is, that the former lives more comfortably in a warmer, drier, more healthy condition than the latter. I have not the smallest hesitation in recommending box-feeding, as, *cæteris paribus*, the fastest method of making beef, and shed-feeding as the fastest method of making mutton.

These, then, have been the conclusions at which we have arrived—that box-fed or shed-fed animals of good breed, fed on purchased food properly prepared, in addition to the utmost produce of the best-grown crops which a thorough fertile farm can yield, will turn out more meat per acre, than is possible by any other animals under any other circumstances. That land must be raised to the highest fertility which the cost of drainage or burning, or marling or liming, of manuring and cultivation, permits—that it must then be made to yield alternately with grain crops, the best descriptions of Swedish and other turnips, of mangold wurzel, of carrots, of clover, vetches, rape, or other green crops, which skilful cultivation can produce, and the best crops of each that cost and climate allow: that, with this produce, linseed and, say, beans, must be bought (or grown) for consumption in the proportion of 1 of the former, and about 3 of the latter, with every 100 of the green food: that this, properly prepared, must be given to good individuals of the Short-horn, Hereford, or Devon breeds of cattle, kept in clean, well-littered boxes, or to good individuals of the Leicester, South Down, long-wooled, or cross-bred breeds of sheep, in well-littered and well-sheltered sheds, before a maximum of meat can be expected.

IV. I have now to consider some other points, perhaps less immediately connected with our subject, to which the Society has called attention; and this I shall do by presenting them in the form of questions, and I put them in the order in which the Society has dictated them.

A. What are the sources from which the supplies of lean stock are derived, and are such supplies on the increase or decrease? To the latter part of this question I imagine the proper answer to be that, excepting our altogether foreign supplies, these sources will, no doubt, generally diminish in productiveness as the agriculture of their several localities improves. There can be no doubt that this will be more and more true of the more improvable districts, such as Herefordshire, &c., from which we now draw the best of our lean supplies. When each locality fattens its own stock, as in the case of an improved cultivation it does, then any extra stock that each may require must, excepting what is reared in uncultivated districts, be brought from abroad. To the former part of the question we may answer:—

1. That it is an increasing practice, already prevalent in our best counties, to fatten one's own stock, and not look to other districts for lean cattle. But this is the subject of our second question, and need not be discussed here.

2. That Ireland has been a productive source of lean stock for the English and Scottish farmer, though not much to his benefit, if our own experience of the quality of Irish beasts is any guide; but that it is a source which, with an improved state of things there, we may expect will gradually dry up. The following are the only returns of importations of live stock from Ireland that I have succeeded in obtaining, and as they include the period of famine, they cannot be considered very instructive. If the quarter ending the 5th of July, 1846 and 1847 respectively, be any guide to a conclusion, it would appear that the supplies have not fallen off as yet:—

Imported from Ireland during Quarter ending	Number of			
	Oxen, Bulls, Cows.	Calves.	Sheep and Lambs.	Swine.
5 January, 1846 .	32,883	583	32,576	104,141
5 April „ .	14,859	183	11,121	15284 1
5 July „ .	33,850	1,923	56,669	124,762
10 October „ .	71,728	2,909	123,372	89,941
5 January, 1847 .	66,046	1,348	68,095	113,276
5 April „ .	28,672	329	25,701	45,993
5 July „ .	54,917	4,423	88,173	14,750

3. That the hill districts of Scotland have been a large source of lean stock. Some of them will more and more feed their own stock than they have yet done, and supplies from some of them, Galloway for instance, will decline. Thus, I am informed by one of the most extensive Galloway dealers, that the quantity of lean stock sent from the three counties, Wigton, Kircudbright, and Dumfries southwards, is at present from 13,000 to 14,000 annually, and that ‘these numbers are likely to diminish rather than increase, as every year the extent of home feeding is increasing.’ The Highland districts of Scotland, however, are likely to supply us in undiminished quantity for many years to come. The stock sold at Falkirk tryst and Doune fair, in the county of Stirling, is a sufficient measure of the Highland supplies; and the following details respecting these markets, extracted from old files of the two Stirling papers, I have been enabled by the kindness of a friend to procure :—

DATE.	ESTIMATED STOCK AT MARKET AT			
	FALKIRK.		DOUNE.	
	‘Observer.’	‘Journal.’	‘Observer.’	‘Journal.’
1836				
October .	40,000	55,000	Bad market	Dull
1837				
August .	Beyond expectation	Very extensive	. .	. .
September	Better than last year	Average	. .	. .
October .	Ditto	Greater	Little business done	10,000
1838				
August .	Ditto	Greater	Great number; sales brisk	. .
September	Bad tryst	18,000	. .	. .
October .	Full 50,000	50,000	. .	Good market
1839				
August .	Average	6,000	. .	. .
September	Smaller number	30,000	. .	. .
October .	Full 70,000	70,000	Sales brisk	5,000
1840				
August .	About 15,000	15,000	. .	. .
September	Less numerous	Short	. .	. .
October .	80,000 to 90,000	. . .	Sales brisk	Brisk
1841				
August .	18,000	18,000 to 20,000	. .	. .
September	Good	Good	. .	Not so many
October .	Numerous	Full	Dull	. .
1842				
August .	Greater number	Very great	. .	. .
October .	Great number	Full	. .	. .
1843				
August .	Ditto	. .	. .	. .
September	Fewer	. .	. .	. .
October .	Great show	. .	Not good	. .

DATE.	ESTIMATED STOCK AT MARKET AT			
	FALKIRK.		DOUNE.	
	'Observer.'	'Journal.'	'Observer.'	'Journal.'
1844				
August .	Bad market	. .	. .	. .
October .	Over average	. .	Short supply	. .
1845				
August .	One-third more, and dull and dear.	. .	. .	. .
September	Below average	. .	Good supply	. .
October .	Fair average	. .	. .	. .
1846				
August .	. .	. .	. .	. .
September	Half the average	. .	. .	. .
October .	Half over average	. .	Very large number	. .
1847				
August .	Short	. .	. .	. .
September	. .	. .	. .	. .
October .	Full average	. .	Beyond the demand	. .
1848				
August .	Below average	. .	. .	. .
September	Not extensive	. .	A great show of cattle	. .
October .	Most extensive	. .	. .	. .

Upon the whole, the above extracts show that these markets are still as fully stocked as they have been, and that we may depend upon their at least maintaining their supplies for a long time to come.

4. But the great source of lean stock now open to us is the Continent: and the supplies imported thence are very rapidly increasing. The following numbers tell us that plain enough, but, unfortunately for the farmer, much of it is not lean stock, but butcher-meat already fatted.

Number of Animals Imported.

	Year ending January 5,				Nine Months ending October 10,
	1844.	1845.	1846.	1847.	1848.
Oxen and Bulls . .	6,782	9,782	17,191	27,811	16,791
Cows	1,754	6,502	25,349	35,138	15,919
Calves	53	586	2,503	12,389	12,389
Sheep	2,801	15,846	91,732	136,527	79,388
Lambs	16	112	2,892	3,349	175
Swine and Hogs . .	265	1,598	3,856	1,242	334

Another return, between which and the above there is some unexplained incongruity, states that there were imported in the years—

	1842.	1843.	1844.	1845.
Catttle . . .	4,264	1,521	4,889	16,870
Sheep . . .	644	217	2,817	15,958
Swine . . .	410	361	265	1,598

These numbers show that there is a source in operation of unknown productiveness, from which we may continue to draw our supplies of lean stock for many years to come, with what profit to ourselves the quality of the animals thus obtained to feed will determine.

B. But let us now inquire in what degree it is profitable, or even possible, to breed our own stock? That, other things being equal, it is advisable to breed one's own stock is apparent from the fact that then the feeder knows the stock he is fattening, and can treat them, as regards quality of food, according as his experience of them has shown to be profitable; and that it is possible the experience of Berwickshire farmers proves.* There the farmer purchases every few years a good bull, keeps a stock of perhaps a dozen cows, and rears, it may be, from 30 to 36 calves; his cottagers, having cows which are covered by his bull, sell him their calves, which are reared along with those of his own cows. One cow thus brings up 2½ to 3 calves; and the cattle thus reared are sold at little beyond two years old, often as heavy as upwards of 7 cwt. a piece. It may be well to state the mode of management somewhat more in detail. The calves are made to drop at various times between the 1st of February and the 1st of April. As soon as dropped the calf is removed from its dam, rubbed dry, fed liberally on new milk thrice a day for a fortnight, then tempted to eat Swedish turnips and oilcake, giving the same quantity of liquid as usual, but now not new milk alone, but gradually more and more diluted with water, and containing perhaps a little oatmeal porridge. The cows all this time receive globe-turnips (but we English farmers cannot grow turnips of such quality as they can in the North), as being more productive of milk than the Swedish. When the calves are from 4 to 6 weeks old they are moved from cribs to a house, several together; and as soon as the yards are empty, to the best and warmest of

---

* The statements regarding Berwickshire experience in this respect are adopted from the paper on that subject in the Highland Society's Transactions, 1841, by Mr. Wilson, of Edington Mains, Ayton, Berwickshire.

these. At 6 weeks the mid-day meal of milk is discontinued, and at 14 weeks they are weaned altogether. At that time their allowance of cake is increased, and they readily eat enough to improve in condition: they are put to grass, and the cake then gradually diminished as they take to this kind of food. They are not permitted to lie out late at night in autumn, but are soon brought in and receive foddering of tares or clover. When put on turnips they receive 1 lb. of cake each in the yards daily, which keeps them improving; and this continues till spring, when they are again put to grass, and then it is discontinued. They are brought in the second autumn, and are fed liberally on turnips and Swedes, &c., during the second winter, and may be sold fat in the following May.

There are two sides even to this subject, however, and there are advantages connected with the purchase over the breeding of your stock, which, if you can easily obtain stock of good quality, may justify the abandonment of the latter plan. The chief of them is its economical use of the farm's resources. When full-grown stock are purchased and brought to a farm, they remove from it when sold only the fat and flesh with which its crops have supplied them. When fat stock, *bred at home,* are sold, the whole of their substance is an extraction from the land, which, if bones are thus taken from it, must be replenished with bone-dust purchased for the purpose, or it will worsen in the process. In the former case the food purchased more than balances the material removed from the land; in the latter, manures as well as food must be bought if fertility is to be maintained. Still there is no doubt that to breed one's own stock diminishes the demand, which would otherwise injuriously increase, upon our supplies of lean stock, which are probably on the decline.

c. Another method of diminishing this demand, and so of suiting it more accurately to the supply, is to keep on fattening stock fully up to maturity before selling it as beef; and it is a question which the Society has put—how far it may be advisable thus to abandon the system of sending stock to the butcher at a very early age? Probably the right answer is—the earlier the *age* the better, provided that, whatever it be, the animal shall have attained full maturity and such a degree of fatness as the market requires. The more rapid the process of feeding, the less the operation of all those constant sources of waste which the lungs and other excretory organs of the animal create; and the more complete the growth and maturity of the animal before it is sold, the fewer will be the individuals required to convert a given quantity of food, and thus the less will be the demand upon an already overtaxed supply of lean stock, and the less will be the demand for bone and other substances out of the soil of which the animal framework is built. It appears impossible to give any other than a qualitative answer to this question. To state the ages at which the different breeds may be profitably disposed of to the butcher would not only be an invidious and probably inaccurate performance, but it would, to do each of them justice, require a specification of the mode of feeding and treatment proper to each, which it would be impossible to give with accuracy or without great tediousness.—This, then, is all I have to offer on the subject of our supplies of animal food.

XVII.—*On Lodging and Boarding Labourers, as practised on the Farm of Mr. Sotheron, M.P.* By THOMAS DYKE ACLAND.

To Mr. Pusey.

DEAR PUSEY,—The arrangement made by Mr. Sotheron for his farm servants at Bowden Park, near Chippenham, so fully comes up to the account we had heard of it, that I cannot refuse to comply with your desire that I should send you a description of it to be inserted, if you think fit, in the Journal. Mr. Sotheron has given his consent to my doing so, and furnished me with the details of the plan and of its results.

When Mr. Sotheron took his farm in hand about four years ago, he found, as usual, a barn of double the size required, and divided one end of it into three compartments, a dining hall, a sleeping room containing six beds, a washing room with a loft over it, for keeping chests of clothes, and a sink communicating with the tank in the yard. The barn doorways are walled up with brick and fitted with glass casements, a large window with a swing sash is opened over the sleeping apartment, one of the threshing floors forms the dais of the dining hall, on which stand a plain large table and some wooden chairs. A lamp, and a long pole for drying clothes, are let down by pulleys from the tie-beams of the roof, a plain hearth and chimney corner have been added at the end, and a cupboard completes the furniture. In this building from five to seven lads have been housed and fed during the last four years. Their wages commence at 4*l.* and rise gradually to 8*l.* 10*s.* per annum. They purchase their own clothing out of their wages. The married man is a good workman and manages the steam-engine. Several of the boys have become excellent ploughmen and have won prizes. After work they occasionally amuse themselves with cricket or other games, or with reading and writing, playing the flute, &c. The weekly expenses of their board per head are as follows:—

	s.	*d.*
Bread and flour	1	1
Meat and bacon	2	0
Groceries	1	0½
Beer	1	0
	5	1½*

They are allowed to come at sixteen years of age, and remain till they marry or obtain situations. The youngest boy cleans out the room, and they take it in turn to prepare the table for meals, which are cooked by the wife of the bailiff, who lives in an adjoining house and has the assistance of one female servant, who is not allowed to go into the building where the young men live. The bailiff's wife also provides for their washing. The young men are under the superintendence of the bailiff, who presides at their meals, and reads prayers with them morning and evening. A bell rings at meal times, and those who are absent from a meal without leave or good cause, go without it. They are required to observe some rules, few and simple, tending to order and cleanliness—such as to sit down to their meals in clean smock frocks, which they put off when they go out again to work. I ascertained that these rules are in no way irksome to them, but have inspired them with a feeling of self-respect—as their phrase is, they are glad to keep themselves respectable. I sat with them at their breakfast table, and conversed with them while the bailiff was out of the room, and can therefore testify to their demeanour being at once intelligent and respectful. There can be little doubt that such a plan, carried on with kindness and good sense, must tend to the best results, and such in fact have been produced.

---

* The following details are taken from the average of the consumption for several weeks:—

	£.	*s.*	*d.*
38 lbs. bread at 1½*d.*	0	4	9
4¾ lbs. flour at 1½*d.*	0	0	7¼
9½ lbs. butcher's meat at 5*d.*	0	3	11½
14½ lbs. bacon at 5*d.*	0	6	0½
5½ lbs. cheese at 6½*d.*	0	3	0
2½ lbs. sugar at 4*d.*	0	0	10
⅜ lb. coffee at 1*s.* 2*d.*	0	0	5¼
½ lb. cocoa at 8*d.*	0	0	4
2 lbs. rice at 2*d.*	0	0	4
Pepper, salt, &c.	0	0	3
Board of five boys	1	0	6½
Board of one boy	0	4	1½
Beer in addition	0	1	0
Actual food of each boy	0	5	1½

To this must be added a small sum per head for washing, soap, and candles and firing.

Of the total number of youths who have been admitted, two have married, one of whom works on the farm, the other for a neighbouring gentleman; four have been placed out in good situations; three, having absented themselves without leave, were not taken back; one left owing to ill health, and afterwards died; five are now at the farm. None have misconducted themselves nor been discharged for any fault.

In connection with these arrangements for the boarding of the farm servants who live in the house, two advantages are provided for the other labourers. A cup of cocoa is given to every person employed on the farm at the time appointed for the beginning of work; and during the winter months nourishing soup is offered to those who choose to pay for it, at the rate of one-halfpenny per quart, which covers the actual cost, and is even more valued than it would be if it were given without payment. The early cup of cocoa is found to have the great merit of allaying the feeling of thirst during the day, which is so great a temptation to labourers: this probably is owing to the irritation of the stomach caused by beginning the day's work fasting being prevented.

The receipt for the soup, which is made *à la Soyer*, is as follows:—

	s.	*d.*
Meat 2 lbs. minced	0	9
Sago 6 lbs.	1	6
Pepper and salt	0	1
	2	4

Making sixteen gallons, which are sold for 2*s.* 8*d.*, leaving 4*d.* to set against the value of the vegetables grown in the garden, fuel, and the time of the servant who makes it.

The merit of these plans, especially of the boarding of the boys, seems to be, that they are natural and simple, in fact a revival of an old English habit, universal some years ago, and still practised, even on very large farms, in the north of England, but driven out in the southern counties partly by the encouragement given to early marriages under the old Poor Law, and partly by the refinement of modern habits, which have banished the labourer from the society of his master, whereas he would derive great advantage from it, and be made a more useful servant.

Yours sincerely,

T. D. Acland, jun.

XVIII.—*The Parasitic Fungi of the British Farm. A Lecture delivered in the Shire Hall of the City of Norwich, at the Annual Meeting of the Society, July* 18, 1849. By the Rev. Edwin Sidney, A.M.

My Lords and Gentlemen,—I have no common satisfaction in addressing you in a county where for many years my humble efforts, made long before similar exertions had become at all general, were so favourably received and kindly acknowledged by all classes of persons. I will not, however, indulge myself by any further preface, but proceed at once to the task I have cheerfully undertaken. I shall endeavour to describe in simple popular language the nature, habits, and, as far as I can, the preventives or palliatives of the principal *parasitic fungi* of the British farm, beyond which, of course, I cannot go; avoiding all needless technicalities, and stamping my explanations with those characters which will promote their currency with every hearer. Whenever I am obliged to use a scientific term, I shall try to explain it; and I commence by remarking that the epithet *parasitic* applied to a plant, means that it lives at the cost of that on which it grows. A *fungus* is a cellular plant without flowers, living on air, and nourished through a *stalk, stem,* or *spawn,* called its *mycelium.* It is propagated by minute seeds or *spores,* or *sporules,* either colourless or not, but never green, and occasionally enclosed in skinny coverings, termed *sporidia,* or *spore-cases. Fungi* live by imbibing juices impregnated with the peculiar principles of the *matrix* on which they grow. The *spores* mostly germinate either by a protrusion of the inner membrane, or by a lengthening of the outer covering; and the *spawn* is the development of these *spores,* or of itself already produced, possessing the power of imbibing the juices just alluded to. The most familiar example is common mushroom *spawn,* which the little seeds will sometimes throw out on strips of glass, so as to be well observed. *Fungals* most commonly grow upon animal or vegetable substances in a state of decomposition; but many of simplest organization attack tissues, in which its commencement is at least not ascertainable, or, if commencing, hasten it beyond recovery.

The simplest form of a *fungus* is common mouldiness, which has two types. The first, as may be seen by the aid of the microscope, is composed of jointed threads made up of simple cells placed end to end, which separate and seem capable of reproduction. This is represented in Fig. 1, where the little cells may be seen placed as described. These cells are capable of being separated, and appear to be reproductive. The second assumes a thread-like appearance, bearing *spores* on the tips of the threads, or on short processes, and sometimes

Fig. 1. The jointed Threads of Common Mouldiness.

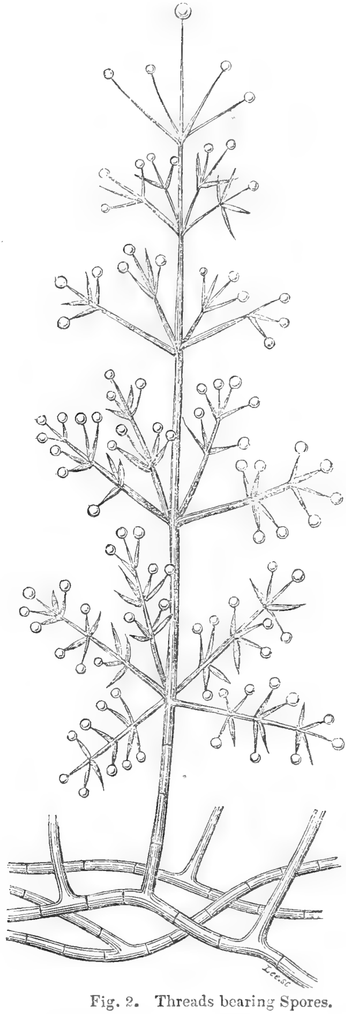


Fig. 2. Threads bearing Spores.

in cases, by the rupture of which they are dispersed. They sometimes assume the beautiful appearance delineated in Fig. 2, where the jointed threads and the attachment of the spores in the way mentioned will be perceived. The actual forms even of these simplest fungals are thus shown to be extremely interesting.

Examples of spores in cases will be pointed out as we proceed. In a higher state, *fungi* take a determinate figure formed of a mass of cellular tissue, the centre of which is all *spores,* attached to it often in fours. This at length dries up, leaving only the dusty *spores,* as in the case of a common *puff-ball.* The most completely formed *fungi* have two distinct surfaces, one of which is even and without any opening, the other separated into plates, called the *hymenium,* or *gills,* to which the spores are attached, generally four together, as seen in Fig. 3. Upon these differences of structure depend those various attempts at botanical arrangement which I have no time to describe. So numerous are the *seeds, spores,* or *sporules* of *fungi,* that it is not easy to conceive a place whence they are excluded. Those which grow on matter in which decomposition has decidedly begun, have been well called "the scavengers of nature;" but others of a most minute description, some of which belong to my subject, apparently attack tissues in full health and vigour. With regard to the properties of *fungi,* I can only mention, in a word, that they are respectively *eatable, poisonous, medicinal, intoxicating,* and even *luminous,* lighting up with their living lustre mines and caverns where they grow, and in some places assuming at night the appearance of pendulous lamps hanging from the trees on which they vegetate.

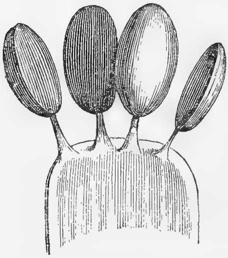


Fig. 3. Showing the attachment of the Spores in fours.

I. I now propose first to describe the chief of those minute parasitic *fungi* which injure the corn and grasses of this country, premising that corn-plants are themselves only grasses, the seeds of which are sufficiently large for our food.

These little pests generally present themselves to the unassisted eye under the form of masses of dust, differently coloured, and appear on all parts of the plants, except the roots.

(1.) The stems or straw of our corn-plants, and also the leaves, are frequently disfigured by a dark series of patches, constituting true *mildew,* and called by botanists *puccinia,* from the Greek *πύκα, thickly,* because of the dense masses of which it consists. It is found upon reed as well as corn, but the microscope reveals a slight difference in the structure of the spores, by which the *puccinia* of one species of plant is distinguishable from that of another. It was imperfectly noticed by Felice Fontana in 1797, but in 1804 was investigated more closely under the auspices of Sir Joseph Banks, on account of its ravages that season, and microscopical drawings, still in the British Museum, were executed by Mr. Bauer. Its common appearance is seen in Fig. 4,

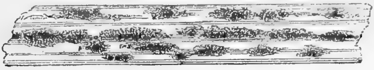


Fig. 4. Common appearance of Mildew.

which represents it on the straw a little magnified. Its appearance, under a first-rate modern microscope is shown in Fig. 5,

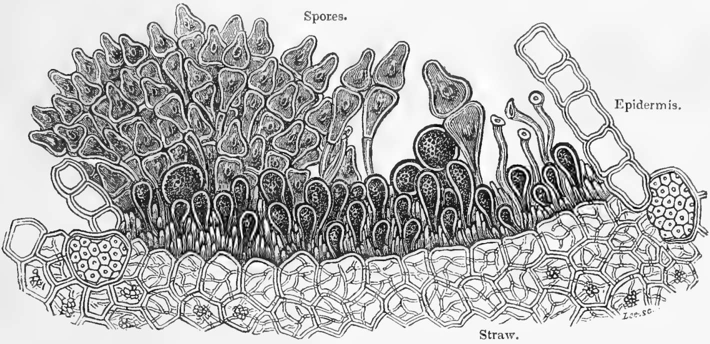


Fig. 5. Puccinia Graminis, or Mildew, magnified.

where you perceive that these dusty patches are crowds of club-shaped *fungi* (spores), the thicker end of each of which is divided into two chambers containing the reproductive *sporules.* They burst through the *epidermis,* or upper skin, which they lift up, and the *sporules,* dispersed through the air, have been thought to find entrance by the *stomata* or *pores.* The ground of this notion is, that the patches of mildew are first seen in small cavities immediately beneath these *pores*, which, as Professor Henslow, to whom I am indebted for the specimens now before you, observes, "certainly looks very much as if the *sporules* entered there." With his usual caution, he remarks, "that the fact stands in need of proof," and that hitherto the evidence is more in favour of similar fungi being imbibed by the roots of the plants which they attack." We shall shortly see that some experiments on another *fungal parasite* of wheat, tend to show that these *fungi* are developed in a manner little suspected even by the most accurate observers. This parasite robs the living plants of their juices, and must not be confounded with a very minute fungus called *dipazea,* which is peculiar to the joints of the straw; nor, as is more common, with another black fungus, which gives a dingy aspect to whole fields towards harvest, and is often called *mildew,* but which never attacks a plant till it is previously diseased, and which, for want of any other name, I am obliged to announce by its botanical one, *cladosporium herbarum*, the character of its growth being, as you see in Fig. 6, totally unlike *mildew*. It grows on old leather as well as on wheat. The dissimilarity to Puccinia is visible enough. Spores may be seen here in their cases. The common appearance on the straw, as shown in Fig. 7, not being accurately observed, misleads. Though I have no other name but the botanical one by which to call it, I can trace its derivation to the Greek *κλαδος*, a branch, because the spores grow on minute branches. Whatever tends to preserve the health of the wheat will prevent also the attacks of this fungus.

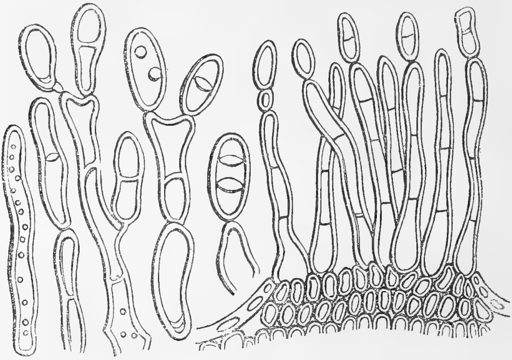


Fig. 6. Cladosporium Herbarum, magnified highly.

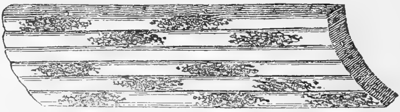


Fig. 7. Common appearance of Cladosporium on Straw, slightly magnified.

(2.) We now come to other minute parasitic *fungi* of corn-plants. They are called *uredines*, the plural of *uredo*, from the Latin *uro*, to burn, on account of the scorched appearance of the parts on which they vegetate. Different parts are attacked by different species: the *uredo* of the maize alone growing everywhere except on the roots. The first *uredo* I shall notice is known familiarly to the farmer as *rust*, *red-rag*, *red-robin*, *red-gum*, and comes out in yellow or orange blotches on the stem, the leaf, and the chaff-scales, appearing as a powder. The hue of a whole field is often affected by it, and fears naturally arise, but it frequently happens that a few days bright sunshine dissipates the *fungus*; but mischief has been done, and the crop feels it. It is called *uredo rubigo*, and under the microscope the *spores* appear as in the drawing, Fig. 8. You may observe the spores in the highly magnified diagram, most accurately drawn from the microscope by Mr. Leonard. They are seen growing on the mycelium, which finds its matrix in the tissues of the plant. There is a curious botanical question whether this *uredo* passes to *puccinia.* I think the best evidence confirms the opinion that such is the case.

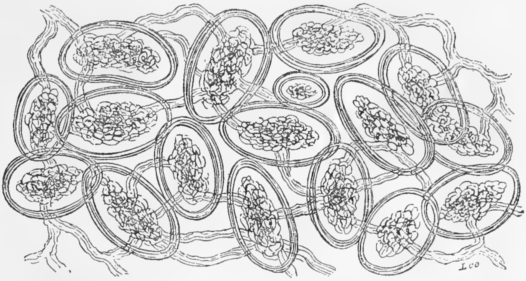


Fig. 8. Uredo rubigo.

(3.) The sooty powder on the flowering parts of corn-plants, called *smut, chimney-sweepers,* and *dust-brand,* is formed of the *spores* of another *uredo,* called *uredo segetum.* It renders the whole interior abortive ; the pedicel of the flower swells, and a black dust occupies the whole. These spores are so diminutive that the diameter of one is only $\frac{1}{2800}$ inch. Strange to say, some farmers welcome its appearance, because they conceive it augurs a good crop, forgetting that whatever ear it attacks, it makes one less in that crop.

(4.) Another *uredo,* called *bunt,* or *pepper-brand,* seizes on the grain of wheat, and that to a great extent if not guarded against. This *uredo* is termed *uredo fetida,* on account of its filthy odour. If you break a grain of wheat infected, you will find the flour replaced by a black mass, oily and fetid, and all the ovary is seen to be destroyed, except the integument, which swells and encloses the *spores,* amounting in a single grain to nearly four millions. They are, like those of *uredo rubigo,* shown in Fig. 9, on their *mycelium* or *spawn,* and are in diameter about $\frac{1}{600}$ inch. This drawing, also from the pencil of Mr. Leonard, shows the spores perfectly as they would appear under an achromatic of $\frac{1}{16}$ inch focal length, with an eye-piece of moderate

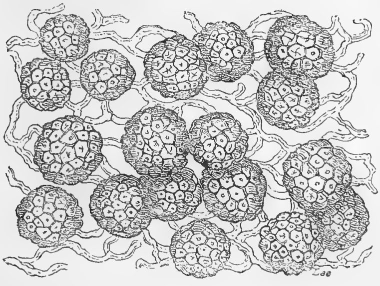


Fig. 9. Uredo fetida.

power. This *uredo* confines its attacks chiefly to the seed of wheat amongst our cereals, but some other plants, as the *convolvulus,* and of the grasses, *rye-grass, bromus,* and *poa,* are subject to have their seeds destroyed in a similar manner.

(5.) These *uredines,* as well as *mildew,* though till recently not understood, have long been the subjects of observation. Moses threatened the disobedient Israelites with mildew, and the Romans had their false god *Robigo,* whom they thought to propitiate for the preservation of their fields from the disastrous attacks of these diseases. A feast called *Robigalia,* to this deity, was always kept on the 25th of April, to deprecate blasting and mildew. The diseases themselves were long matters of curious speculation, and they were, till lately, regarded as accidents of vegetation resulting in a mass of injured cells from the dampness of the soil, excess of manure, or fogs, or punctures of insects, and have even been attributed to the presence of the berberry, a fungus of which, called *œcidium,* is shown in Fig. 10. On the left is seen a piece of the leaf of the berberry with the spots of *œcidium* upon it. On the right, one of these receptacles, containing spores, is magnified to show the form of this fungus. The mycelium on which it grows is also visible. There have been many botanists who have believed that the spores of *œcidium* come up as *uredines* when they fix upon any cereal. It is the microscope which has enabled us to recognise in all these parasites a true *fungal* character, and to trace their growth; but the damage accruing from them has not been adequately estimated, for they never appear in the farm or garden without injury to the produce. For example, few can have failed to notice the effects of *uredo* on the rose-trees, and also, but less frequently, on geraniums.

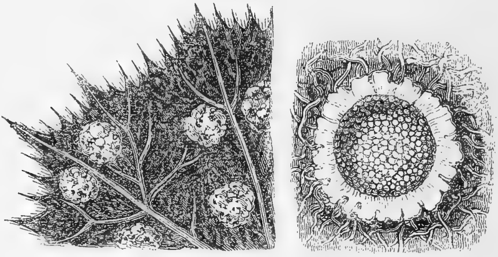


Fig. 10. Œcidium of the Berberry.

(6.) Numerous have been the speculations, and often ingenious the experiments, on the way in which the reproductive sporules find entrance into corn-plants. Various remedies have been tried, and some with success, as in the case of *bunt,* or *pepper-brand,* which may be effectually checked by good dressing of the seed. The principle of the dressing is the conversion of the adhesive oily matter of the *spores* into that which is soapy, which is easily washed off. This requires an *alkali,* and suggests the use of a ley of potash, soda, or wood-ashes. Liming also has a good effect. Sulphate of copper and arsenious acid, the arsenic of the shops, are often used; but, besides the other objections to them, there is the danger to the vegetative powers of the seed. It is not usual to dress for *smut,* which attacks not only wheat, but barley and oats; yet the same reason applies in these cases, except that more difficulties are in the way because of the dissipation of the sporules before harvest, and the remainder being knocked out in threshing. It is important to ascertain with certainty how the contents of the *spores* grow. Those of *bunt* are too large to enter the *stomata,* yet if sown with wheat it reappears. Some think the *mycelium* divides in the earth into molecules, each of which has a vegetative power, and that any one absorbed by the roots extends till it reaches its peculiar point of election in the system. Others conceive that the *spongioles* of the roots imbibe the fine contents of the *spores,* which grow. It is certain that due dressings and washings prevent the reappearance of *bunt,* and that excess of manure encourages *red-robin* and *mildew,* which have also been observed to follow long feeding with sheep. Amongst the antidotes to mildew, I venture to name clean farming, amendment of the texture of the soil, ventilation and letting in light, checking over-luxuriance in the young plants, growing early varieties in places subject to it, and avoiding putting on manure directly before wheat, and hoeing the wheat when young.

(7.) There seems no reason to believe that any *uredo* mentioned is deleterious, though *bunt* is disagreeable in the flour. It has been said that in past times there were gingerbread-bakers who had no objection to flour which contained the black matter of *bunt,* as it saved them the brown sugar which they must otherwise have used to render this confection sufficiently dark-coloured for the approbation of their customers. If such customers there ever were, they must have had more regard to appearance than to quality. But I am now about to describe a *fungus* closely allied to *uredo,* which attacks grasses for hay, that appears to be quite poisonous. It is termed *ustilago,* having a similar derivation with *uredo,* and is left by Corda in his general classification, in the same group. Tulasne wrote a long paper on *ustilago* in 1847, with drawings. The one in question is called *hypodytes.* Its spores are black, round, and very small, and I shall call it *grass-smut.* There was a great deal of it in 1848. In a field near King's Cliffe almost every flower-stem of the *bromus sylvatica,* which was one of the principal grasses, was infected by it. A plan twas taken by Mr. Berkeley from this field, and instead of its throwing up fertile spikes, almost every one is attacked.

The structure in a very young stage is thread-like, but all traces of *mycelium* soon disappear, and nothing remains but a mass of minute spores (Fig. 11). The whole was drawn by Mr. Leonard from the specimen this day exhibited to the audience. In addition to the ruin of the grass, this *fungus* is most pernicious. According to Leveillé, the immense quantity of black dust resulting from it in the hay-fields in France, produces disastrous consequences on the haymakers, such as violent pains and swelling in the head and face, with a great irritation over the entire system. A like account was given of these peculiar maladies by Michel, in 1845, which he compared to the well-known effects of *ergot,* on which singular abortion of the seeds of corn and grasses I do not enlarge here, because though accompanied by a *fungus* called *ergotetia,* it cannot be called one. Botanists term it *ergotetia abortifaciens,* or *ergot fungus, rendering the seed an abortion*; but the only argument they adduce in favour of its producing *ergot* is, that it constantly attends it. But it is clear that because two things are coincident it does not follow that they are cause and effect, while the best examination does not warrant such an inference in this instance. I will only remark that it is more common than is supposed, and I am persuaded that cattle in ill-drained localities, where it always abounds, derive serious injury from it, and that it is the unsuspected cause of many disorders both in them and human beings.

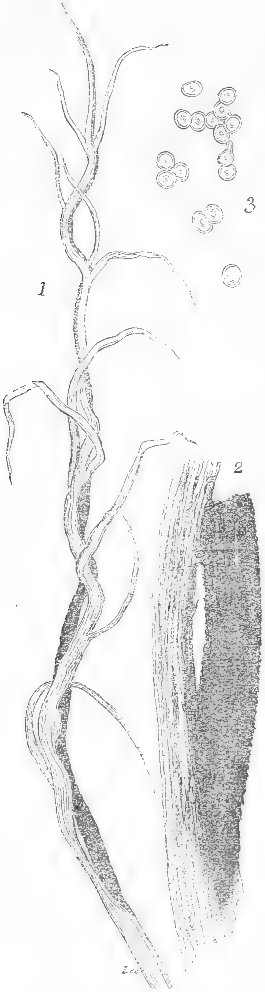


Fig. 11. Ustilago Hypodytes.
1. Represents the stem covered with the black spores.
2. Shows a portion magnified.
3. Shows the spores under a high power of the microscope.

Another *ustilago,* named *typhoides,* damages the stems of reed, swelling and distorting them, and rendering them almost useless for thatching.

The only remedy for such a disease in a grass-field seems to be breaking it up, and substituting for it a crop not subject to its ravages.

I have not time to dwell on other kindred *fungi* found occasionally on the gramineous tribes. All are more or less subject to some *uredo* peculiar to them.

(8.) I may be expected to allude to the true theory of *fairy rings,* which are due to three species of the most highly organized fungi, called *agarics.* Mushrooms are *agarics.* Those of the *fairy rings* throw out their spawn in a circular direction, and the ground being continually exhausted by it, a ring is formed, which is rendered greener than the surrounding grass by the stimulus of the *spawn* itself.

I may just observe that in some countries, grasses and corn, and particularly barley and rye, are destroyed by a curious mould, which is developed beneath the snow, and if it appears in snow without previous frost, it is often fatal to the whole crop. It has not yet been noticed in Great Britain, but the matter will be worthy of attention should any long frost occur.

I cannot omit to state here that the mouldiness in stacked hay is generally the common *aspergill,* to be described presently, and sometimes the common *penicillium,* also coming under review. The *spores* of these will be seen to be injurious, and therefore such hay ought always to be steamed. The cut surface of hay-stalks is sometimes covered with a light orange or brick-dust red *fungus*, which is a *fusarium,* so termed from the spindle shape of the spores, but it is entirely confined to the section of the stems composing the hay.

II. I go on next to the *parasitic fungi* of leguminous plants, which are particularly subject to them. A small *dipazea* destroys peas in wet seasons, attacking all parts, especially the pods; but the blight which we mostly see on peas, bears the botanical name *erysibe,* or *erysiphe,* the Greek for *mildew,* and is the same kind of mould that infests peach-leaves. In its early stage it is a jointed mould, seemingly superficial, which on examination shows little globules, changing from yellow to black, and springing from a flocose web, filled with minute sacs containing the *sporules.* (See Fig. 12.) These globules, and the sacs containing the spores, are

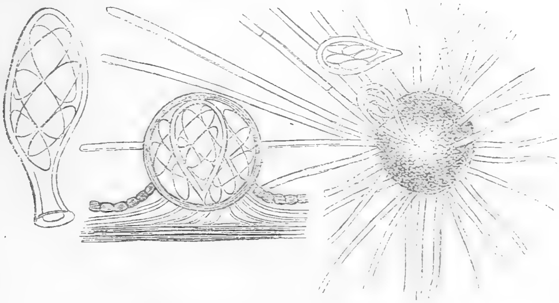


Fig. 12. Erysiphe highly magnified.

here depicted; and a good idea may be formed from inspecting the drawing, of the character of this fungus, as exhibited by the microscope. They put out fibres, which lift them up from the surface of the leaf, and are preceded by threads, white or greyish, consisting of bead-like joints, of which it seems the uppermost fall off and grow.

Beans are injured by a *uredo*—the *uredo of the bean*—which was very prevalent last year.

Vetches are attacked by a fungus styled *botrytis,* from the Greek *βοτρυς*, a bunch of grapes, because the spores grow in this way. (See fig. 13.) This drawing shows a minute portion very highly magnified, and will convey a just idea of its appearance and of the cause of its name. It is called the *botrytis of the vetch*, but in some places it attacks peas and lucerne, and it might therefore bear the name of the *leguminous botrytis. Botrytis* is distinguished from other moulds, which are articulated, and so named *monilia* or *necklace* moulds, by it not having its threads jointed.

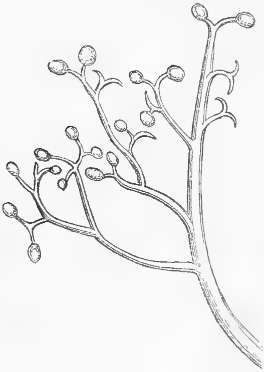


Fig. 13. Botrytis of the Vetch.

Dutrochet first stated, and I have verified it myself by a series of experiments detailed in my little work on the blights of the wheat,* that if a single drop of almost any acid is mixed with *albumen,* in eight or ten days *necklace* moulds appear; but, on the other hand, *caustic alkali* gives botrytis. With fibrine of blood and phosphoric acid, the results are reversed. Every sort of vegetable matter I tried with acid yielded a mould, but when *albumen* contained a neutral salt none appeared. If salts of mercury are present the development is stopped; æthiops mineral does not check it; oxide of lead hastens it; oxides of copper, nickel, and cobalt, retard it; oxides of iron, antimony, and zinc, have no effect; all perfumes stop it. Flowers of sulphur effectually check the *erysiphe* on the peach, but they could not be applied to pea-fields. How far a knowledge of the facts I have just stated may lead to a remedy, easily applied in the shape of manure, future experiments may show.

III. These observations naturally lead to the *botrytis infestans,* found on the leaves of the potato when suffering from the true murrain. The *mycelium* of this fungus traverses the entire cellular structure of the plant, and emerges from the *stomata* of the leaves, choking them, and the consequence is decay.

---

* The title is "Blights of the Wheat and their Remedies."

Fig. 14 shows the microscopic appearance. This fungus is, I believe, new to Europe; so widely distributed a species could not have been overlooked. This diagram is the same as that given by Mr. Berkeley in his admirable paper on the potato fungus. The mycelium may be observed traversing the cellular tissue of the leaf, and one of the threads of botrytis, that to the left, issuing from a stoma. Mr. Berkeley, the very highest authority, is of this opinion; and he writes me word, "I am convinced more and more that the fungus is the real enemy." Certainly, all other theories have failed. The principles of the geographical distribution of food-plants plainly show us that extremely minute and inappreciable differences in *climateric* condition may throw plants into an unhealthy state; which conditions might exist unsuspected for a few years. Hereby plants may be brought into a state which renders them capable of being attacked by certain parasitic fungi, of which the potato blight may be an example, and the *botrytis infestans* become, as it really seems to be, the proximate cause of the malady. The *botrytis* is found on the tubers; but besides this a *fusarium*, which must not be confounded with the former, nor regarded as characteristic of the potato disease, but of another, often occurring in the same tuber with it. (See Fig. 15.) This fusarium, highly magnified, is represented in this figure. It will be perceived to be totally different from the botrytis, and the spindle-shaped spores tell the origin of its designation. Genuine science alone enables us to make such discriminations; and

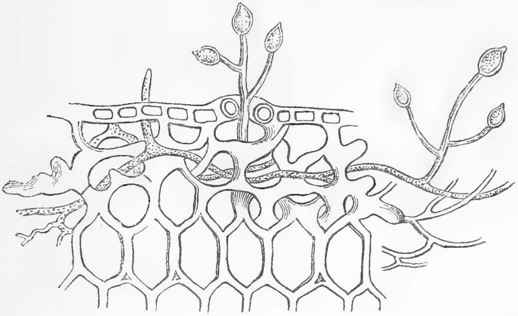


Fig. 14. Botrytis infestans.

Fig. 15. Fusarium, from the tuber of Potato.

it is not too much to hope that experiments founded on some such results as I have announced from the few I have had leisure to make, may lead to the discovery of a check to the growth of this pestiferous *botrytis.*

The root crop of the farm suffers much occasionally from *fungal* diseases. Parsnips are subject to a variety of the *botrytis parasitica,* which blights the leaves. The leaves of turnips are attacked by the same fungus; but a different one, called *fusisporium,* is found on the roots, but with no extensive injury. Mangold-wurzel is affected by the *uredo of beet,* with brown or black spores like that of the bean; but in all these cases the connexion between the disease of the leaves and decay of the roots has not been sufficiently observed.

IV. Hops are damaged by an *erysiphe,* having the habits of that of the pea. It seems to be in its early stage a peculiar mould, but this opinion needs fuller confirmation. The whole subject needs investigation, and I therefore do not dwell upon it.

V. I now pass from the parasitic fungi of the fields to those found in other parts of the farm, its buildings, yards, and interior economy. The *fungi* destroying timber are not sufficiently known, though their effects are so common. *Dry-rot* is generally attributed to the *spawn* either of the *merulius lacrymans,* or *weeping morel,* so called from the little drops of water it contains, or to that of the *polyporus destructor,* named from its many pores. But any of the fungi found on wood, and they are numerous, are capable of producing it; and amongst them are, besides the two mentioned, another *morel* called *vastator,* the *dædalea* of the oak, deriving its appellation from its labyrinthine structure; various *polypori, thelephora,* from θηλη, a *nipple,* by reason of its papillose surface, and *sporothricum,* the spores bearing hairy filaments. (See Fig. 16.) The microscopic view of a morsel of sporothricum

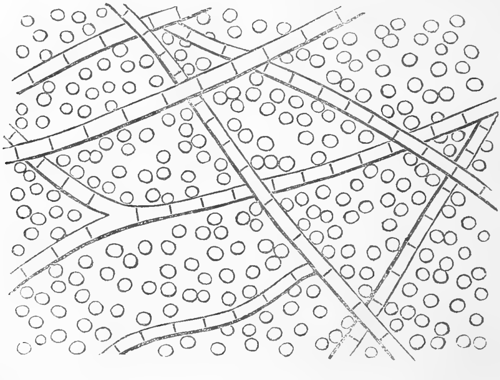


Fig. 16. Sporothricum.

(*vide* Fig. 16) is here given, very highly magnified. The effects of all these pass by one designation, *dry-rot.* I will now describe its progress. The first signs are small white points from which a filamentous substance radiates parallel with the surface of the wood. This is *spawn*, which, as it gains strength, insinuates itself into any crevices however minute, and the threads are so fine that they pass between the tubes from which the wood is organized, and forcing them apart, destroy all cohesion. (See Fig. 17.) This diagram shows these threads from one of the polypori. Sometimes various *spawns* interlace and form a tough stratum; and the rapidity and force of increase are such as to cause, under favourable circumstances, the total ruin of the wood. From the experiments previously described on the growth of *fungals*, you will perceive that the acidulation of the fermenting sap promotes their growth. *Kyanizing*, or the application of *corrosive sublimate*, has been resorted to as a preventive. An experiment may be made to show its effects: a solution of fish-glue will be found to yield *fungi* in abundance, but if *corrosive sublimate* be mixed with it none appear, and the same result will follow additions of certain preparations of copper and other mineral poisons. Oak felled in the spring, when full of sap, is almost sure to have *dry-rot,* therefore that which is destined for farm erections should be cut in winter, for otherwise the only chance of stopping the appearance of the fungi is to substitute some poison by saturation for its proper juices, or to force them out by an objectionable pressure. Immersion in water is beneficial, but heat applied to dry the wood only hastens the malady. In Brest *dry-rot* is said to be unknown, and all the timber used in its yards is kept in a creek of the harbour.

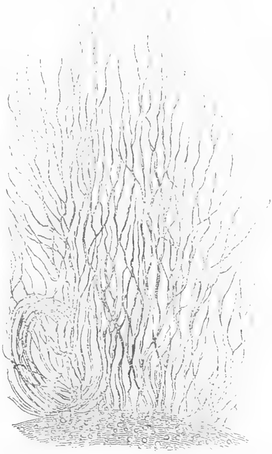


Fig. 17. Threads from a Polyporus.

VI. Fungi of a different kind from any yet described follow the British farmer into his dairy, and interfere with his household economy. *Penicillium* and *aspergill* are two terms applied to some of them, because in their microscopic appearance, given in the delineation before you, they resemble sprinkling brushes. (See Figs. 18, 19.) Fig. 18 represents the *Penicillium* very highly magnified. *Aspergill* is shown in Fig. 19. They are sufficiently indicative of their names. *Penicillium* is the mould on hay, as

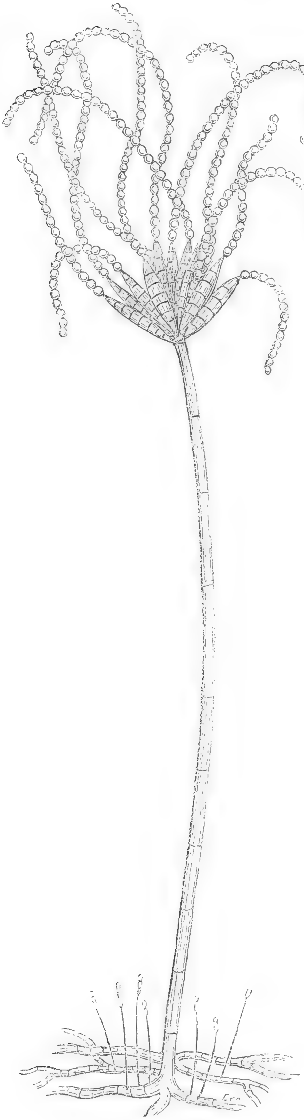


Fig. 18. Penicillium.

Fig. 19. Aspergill.

was mentioned, and is found on bread, and also in the inside of casks, and there is reason to believe its spores poisonous, for two coopers who entered a great tun, covered with this mould, to clean it, inhaled them, and were seized with violent pains in the head, giddiness, and vomiting, which only yielded to severe medical treatment. A *penicillium* is the mould of milk, and we have here a magnified representation of its development. (See Fig. 20.) The penicillium may be here noticed developing itself from the mass of mould. If these moulds appear much in the dairy or on the bread kept in it, the best remedy is washing the walls with chloride of lime, which it is important to know, as milk often suffers greatly in this way. Foreign badly made cheese has an unpleasant mould in brilliant scarlet patches; but in England the principal one on cheese is an innocent mould called *torula,* from *torus*, a bed, from its coming in layers. I may here just observe that the vinegar plant, as it is called, is in its advanced state a *penicillium;* and the beer *fungus* has been called *torula;* but before we decide the latter, we must see a regular fructification in air. There are hundreds of non-productive *spawns* for want of air and light, as, for example, the strange forms which diffuse themselves in cellars, which are incomplete developments.

Fig. 20. Penicillium on Milk.

You will permit me to state in this place, that the fungi on stored fruit are a *torula,* a *penicillium,* common fruit *mucor,* and a mould like the first stage of the *erysiphe.* Harting asserts that he has actually propagated the potato disease from the brown matter in mouldy apples and pears, and it is remarkable that some ingenious experiments of Mr. Berkeley, on the growth of *bunt,* lead to show that its propagation may arise from mere grumous matter in the *spores,* which proves that many of our theories are immature. The experiments were thus made :—Wheat seeds were immersed in a mixture of water and the *spores* of *bunt.* A curious mould with conjugated *spores* sprung up on the *spores* of *bunt.* The wheat was sown, and the plants came up infected; but no communication could be traced between the cells and the shoots thrown out by the *spores;* no intrusion of the *mycelium* developed by the *spores* into the wheat could be discovered. The inference is that the fine contents of the *spores* propagate the *fungus;* but this is quite opposed to our general ideas of the growth of *fungals.*

VII. I will lastly touch on the facts now established relative to the *fungi* attacking animal tissues, which are very surprising. *Sapy* meat has always a *fungus* something analogous to what is called the *yeast fungus.* This *fungus* is a mass of *molecules*, probably an early state of the same that is called the *Vinegar Plant*, the last stage of which has been stated to be a *penicillium*. What are called *sclerotia,* from σκληρος, *hard,* appears in animal matter under particular circumstances; but these are only states of other *fungi*, for even *agarics* have been known to spring from them. The *fungus* of the West Indian wasp, of the caterpillar of New Zealand, and the *muscardine* of the silkworm, are all well-known examples of *fungi* attacking living animals. The last is easily propagated by inoculating healthy caterpillars, which I mention to show that a *fungal* disease may be conveyed from one animal to another in a state of health. I believe a more accurate knowledge of such facts will be ultimately of great use in investigating certain diseases prevalent among animals of the farm and hitherto inexplicable. Sclerotia have been found in bad fractures, but they are not *parasites;* true *parasitic* animal fungi grow only on the skin or mucous membranes. M. Robin published in 1847 a most curious account of the vegetable matters growing on living mammalia, which he classes into two divisions—those of the skin, and those of the mucous membranes. The mucous membranes of the digestive canal and of the lungs are subject to their attacks; nor is the stomach free. All herbivorous animals are liable to moulds in the digestive canal, very like the *yeast fungus,* but larger; yet it is confined to them, and never found in carnivora, birds, or reptiles. A *penicillium* of birds is tolerably well known; and pheasants, fowls, and pigeons are the prey occasionally of a mould as yet imperfectly described. An *aspergill* is found in eggs; and that found in the air-cells of the lungs of the eider-duck has been often noticed. Parasitic animal fungi yield, it is said, to sulphuric acid, whence a hint may be obtained as to remedy; but I wish to speak with due caution on these novel investigations. Attempts have been made to inoculate dead animals with these *fungi;* they have entirely failed; the life of the animal is essential to their growth, the conditions of which seem generally to be imperfect states of respiration or nutrition, or irregularity. There seems to be a moment when the powers of assimilation flag, and then the *fungi* step in and appropriate the nourishment designed for the system. It may be the same with apparently healthy plants. We may here have the first ward of the key to many a hidden secret as to the ailments of the animals of the British farm.

VIII. I have now completed my humble attempt to give a popular outline of the chief *parasitic fungi* of the farms of England, which only require simpler names to be easily understood; and the farmer must learn to distinguish them from the diseases of the superficial tissues. It is a subject well suited to farmers' clubs, where good botanists and microscopists might be induced to attend with their instruments, and give simple explanations. Let it be remembered that simplicity is the handmaid of all useful science, whose truths are only impeded by needless grandiloquence. I can say by experience that endeavours to propagate it will be found good subordinate auxiliaries to the higher aims of men of my own sacred calling; and while we see that there is not a thing so small or so apparently mean, but that it sparkles with some beam of the skill of its great Maker, I conceive that it befits the office I bear to show that the nobler teaching of Divine Wisdom by things revealed, does not tend to deface, but to elevate, our conception of God's perfection in things created. This earth was not made to be neglected, nor man to be unobservant; and if these unpretending gleanings I have gathered in my few moments of leisure shall this day have proved in the least degree acceptable to the present audience, or generally of any interest to the British farmer, of the kindness of whose disposition I had more proofs than I have deserved, I shall rejoice in the honour conferred upon me by being allowed the privilege of addressing you.

XIX.—*Experiments on the Application of Guano and other Manures, in the Duke of Somerset's Park at Stover, near Newton Abbot, Devon.* By E. S. BEARNE.

No. 1.

REPORT of an Experiment to test the comparative efficiency of five different kinds of Artificial Manure in improving Pond Mud, the experiment being made on an acre of inferior pasture land in Stover Park, in the years 1847, 1848, and 1849.

The land on which the experiment was conducted is of uniform quality, the soil being a light, sandy loam, a few inches in depth, incumbent on a stratum of white clay.

The land underwent thorough draining in 1844, prior to which it would not produce a rent of more than 5*s*. an acre.

No manures were applied to the land in 1848 or 1849.

The object sought to be attained by extending the experiment over a period of three years was to test the *durability* of the different manures.

No.	Manures applied in 1847.	Weight of hay cut in 1847.	Weight of hay cut in 1848.	Weight of hay cut in 1849.	Weight cut per acre in 1847.	Weight cut per acre in 1848.	Weight cut per acre in 1849.	Cost of the Manures.
		lbs.	lbs.	lbs.	Seams of 3 cwt.	Seams of 3 cwt.	Seams of 3 cwt.	£. s. d.
1	Six cubic yards of mud mixed with six cwt. of Salt	312	327	613	4⅔	4¾	9	0 14 0
2	Six cubic yards of mud mixed with 1½ hogshead of Lime	353	337	538	5¼	5	8	0 13 6
3	Six cubic yards of mud mixed with three bushels of Bone-dust	511	419	670	7½	6¼	10	0 14 3
4	Three cubic yards of mud mixed with three cubic yards of Tan-yard refuse	524	354	558	7¾	5¼	8⅓	0 14 0
5	Six cubic yards of mud mixed with 90 lbs. of Peruvian guano	930	550	725	13¾	8	10¾	0 14 0

N.B.—The after-grass in 1847 was stocked with sheep, but in 1848 it was left unconsumed.

No. 2.

REPORT of an Experiment made with the under-mentioned Manures on an acre of pasture land in Stover Park, in the year 1849:—

The manures, when mixed with a small quantity of fine earth, were applied broadcast on March 29th, and during the rainy weather which prevailed at the time.

The land is of a fair average quality, and was formerly used as tillage land, but has been in pasture for many years.

The crops were mown on 22nd June, and the herbage produced by the different manures was of a superior quality.

No.	Manures applied.	Quantity of Manures applied.	Quantity applied per acre.	Weight of hay cut.	Weight cut per acre.	Cost of the Manures.	Cost of the Manures per acre.
		cwt.	cwt.	lbs.	Seams of 3 cwt.	£. s. d.	£. s. d.
1	None	. .	. .	401	4¾	. .	. .
2	Superphosphate of lime	2¼	9	616	7⅓	0 18 0	3 12 0
3	Nitrate of soda	1	4	706	8⅓	0 18 0	3 12 0
4	Peruvian guano	1½	6	1210	14⅓	0 18 0	3 12 0

Stover, near Newton Abbot, Devon,
September 22, 1849.

XX.—*Labourers' Cottages.* By J. YOUNG MACVICAR.

SECOND PRIZE ESSAY.

THE want of Labourers' Cottages throughout the country is much to be deplored; nevertheless it is a paramount duty incumbent on every proprietor to provide habitable dwellings for the labourers belonging to his estate.

How often, however, do we find a state of matters the very reverse! In some instances, no opportunity is lost of removing a cottage in order to rid the property of what is deemed an incumbrance; and, with the exception of the favoured villages adjacent to the mansions of our nobility and gentry, Cottage building—of a kind adapted to the wants and within the means of our agricultural labourers—is far from being popular.

How this neglect has arisen towards so industrious and peaceable a portion of the community—how so little attention (with some praiseworthy exceptions) has hitherto been paid to the dwelling of the agricultural labourer, it may be well to inquire.

We believe the omission is in a great measure attributable to two causes. First, to the want of due consideration of the claims of the labourer, in comparison with those of the larger occupier: for, on the one hand, we have seen arise the commodious farmhouse, replete with every convenience suited to a refined state of society, and extensive offices attached thereto, adapted to the wants of every domesticated animal. On the other hand, without drawing a comparison farther than we are warranted, we shall find upon investigation that the labourer's cottage has not advanced in respect of comforts in the same proportion. Secondly, it may be attributed to the want of personal knowledge, on the part of our English noblemen and gentlemen, of the actual state or manner in which the labouring population is in general housed.

Their sympathy may have been excited on perusing the sickening details of the evils arising from the crowded state of the dwellings of the poor, as set forth in the valuable Report on the Sanitary Condition of the Labouring Classes; but they have little suspected that a careful examination of the cottages on their own estates would, in all probability, have shown these to be *not* the abodes of comfort and cleanliness, but of squalid wretchedness, resulting from the unavoidable and indiscriminate mingling of their numerous inmates and occupants.

It is saddening to reflect on the demoralizing influence which such a state of society must inevitably produce upon the minds of the rising generation. Much, of late years, has been done to extend the advantages of education to the poorer classes; and, no doubt, giving their children both religious and moral instruction is a great national advantage; but it must be kept in mind, that the lesson of morality and religion taught in school will be of no avail, will be neutralized, if at the same time the child is not brought up at home in habits of cleanliness, order, and the external proprieties of life, by which, conjoined with a sound education, and in dependance upon the Divine blessing, we can alone hope to render him a good and useful member of society.

To the kind and considerate proprietor—to the zealous parochial clergyman—to all who consider the bearing and tendency of such a measure upon the moral and physical condition of the labourer, this step in the right direction will at once recommend itself; and all, practical men especially, who have had opportunity of seeing and forming a judgment of the necessities and privations of the agricultural labourer, must hail with satisfaction well-considered and matured plans for the amelioration of his condition.

Before proceeding to detail the construction of the cottage I have found best adapted for the dwelling of the labourer, I beg to offer a few remarks upon the auxiliaries connected therewith, for the improvement of his condition, which I trust will with the aforegoing not be deemed altogether irrelevant to the subject now under view.

Considering it most desirable that the bands of mutual goodwill and attachment should be strengthened between the proprietor and his cottager, we would hold out to the latter a fair and reasonable prospect that industry and good conduct will assuredly lead to his advancement in life and the increase of his comforts.

Those who are acquainted with the wishes and ambition of the industrious cottager well know how ardently he desires to become the occupier of land sufficient for the keeping of one or two cows; an advantage which, connected with the cottage garden or allotment, will effect a most salutary and beneficial influence on his life and morals, by giving him something to look forward to, as a prop in his old age, or an assistance when his strength through sickness has failed, and, although willing, not so able for work as heretofore.

And here let me not be misunderstood: I deprecate the idea of the cottager becoming a poor and needy husbandman; but no dread of this result need be entertained by an extensive proprietor allotting in his different parishes to the most deserving cottagers in his village a convenient portion of grass-land, at a rent *not exceeding* that which would be charged to the farmer.

In the next place, I would recommend that the cottage holdings should be rented direct from the landlord, as it induces him to exert a greater influence in correcting and removing any evils which may exist either in the state of the cottage dwellings or in the habits or morals of their inmates. These considerations are too frequently overlooked when they are sublet.

In support of my argument, that cottages should be held direct from the landlord, I gladly quote the following remarks made by His Grace the Duke of Buccleuch at the last general meeting of the Highland and Agricultural Society of Scotland, lately held at Edinburgh:—

"The Duke of Buccleuch said that nothing was more disgraceful than the condition of the cottages of the labouring classes in many parts of the country, even at this present moment, though of late years great improvements had certainly been effected. The system in many parts of Scotland was unfortunately a very erroneous one, for it was very rare that a cottager held his cottage directly from the proprietor. In almost all cases, especially in the south of Scotland, the cottages, often in whole rows, were let to the farmers as a portion of their farms. The proprietor had no more to do with the cottagers and with these houses than he had with the animals which occupied the stall of the farm-offices.

"The system of letting the labourers' houses with the farm was neither good for the proprietor nor the labourer, and he had felt it to be so great a grievance, that whenever it was practicable he had tried to remedy it. He had only the day before taken an immense number of cottages entirely into his own hands, reserving for the farmer such as were necessary for the accommodation of yearly servants, but letting the greater number of the cottages to the day-labourers, who were to pay the rent directly to himself. It was their interest also to keep respectable people in those houses; and if any one was in possession of a cottage who had not that character, the proprietors would be enabled by that means to keep them under control."

Upon the estate which the writer of the aforegoing remarks has the honour and pleasure of superintending, the proprietor has within the last few years erected upwards of fifty labourers' cottages of different designs; some single, others double, and in two instances four and six dwellings combined together; but the plan which has been found most suited to the habits of the labourer and his domestic privacy, at the same time combining economy in expenditure, is a double cottage, with three bedrooms (in each), for the best arrangement and construction of which the Royal Agricultural Society of England has offered a prize.

Two plans, accompanied by the elevations, specifications, and estimates of the cost, are hereunto annexed.

Plan No. 1 has been erected in numerous instances, according to both the elevations, and the arrangement has given general satisfaction to the occupiers.

Plan No. 2 has not been executed, having been presented to the writer of this essay during the prosecution of the subject, by the architect who has drawn out the plans and specifications; and whose able assistance in bringing the author's ideas and wishes into a tangible and practical form, he has great pleasure in acknowledging.

Situation.—Although this must be determined by local circumstances, the cottage should, as a general rule, be placed near to, and the front (or side) parallel with a public road, having, if practicable, a south, or what is even more to be preferred, a south-east aspect.

The ground on which it stands, if not naturally quite dry, should be made so by thorough-draining; and, where attainable, the cottage should be surrounded by an ample garden, divided into two portions, the smaller in front, and the principal one behind the cottage. Where this arrangement can be carried into effect, we consider it much more convenient and desirable than an allotment of land in a distant field.

The garden in front for raising vegetables, with a small plat for flowers, should contain about 20 perches. A garden of this size, the labourer, generally speaking, can easily manage at his vacant hours.

The principal garden, for the cultivation of the potato, may vary, according to the circumstances of the occupier, from a rood to half an acre; beyond which size it is very rarely advisable it should be extended, as interfering with the duties of the daily labourer.

PLAN No. 1.

Description.—**A.** Is the porch, entered by two steps, forming an ascent of 12 inches, and from which there is a separate entrance to the front and back kitchens.

B. The back kitchen or scullery, 9 feet 6 inches by 9 feet, and provided with a fire-place, boiler, and sink.

C. Front kitchen, or living room, 14 feet by 13 feet.

Warmth being essential for the comfort of the cottage, the fire-place is carried up in the middle wall; and, from the position of the window and doors in this room, it will be observed that no draught of air can incommode the inmates. A cupboard, or shelves, may be placed in the recess on each side of the fire-place. The kitchen-range ought to be fitted up with an oven on the one side and a boiler on the other. (We have tried the cottage-grate by Nicholson of Newark, for which a prize was awarded by the Royal Agricultural Society in 1848, and have found it well adapted for the use of the cottager, "combining safety and economy of fuel, with effectual warmth and facility for cooking.")

D. Pantry, 8 feet by 6 feet. The walls are fitted up with shelves, and there is a closet under the stairs. The window ought to be provided with a zinc perforated blind.

E. Cupboard, off the living-room.

F. F. Staircase and landing, from which there is a separate entrance into each of the bed-rooms. There is also a small window, for lighting the stairs, &c.

G. Principal bed-room, 14 feet by 10 feet, in which there is a fire-place, which, although perhaps seldom used except in cases of sickness, is most desirable on account of ventilation. (We have seen the drawing of a bed-room cottage-grate, also by Nicholson, on the same principle as his kitchen-grate, which we think will be equally efficacious.)

H. Bed-room, 9 feet by 8 feet.

J. Bed-room over back kitchen, 9 feet 6 inches by 9 feet.

K. Coal-house, 9 feet by 5 feet 3 inches.

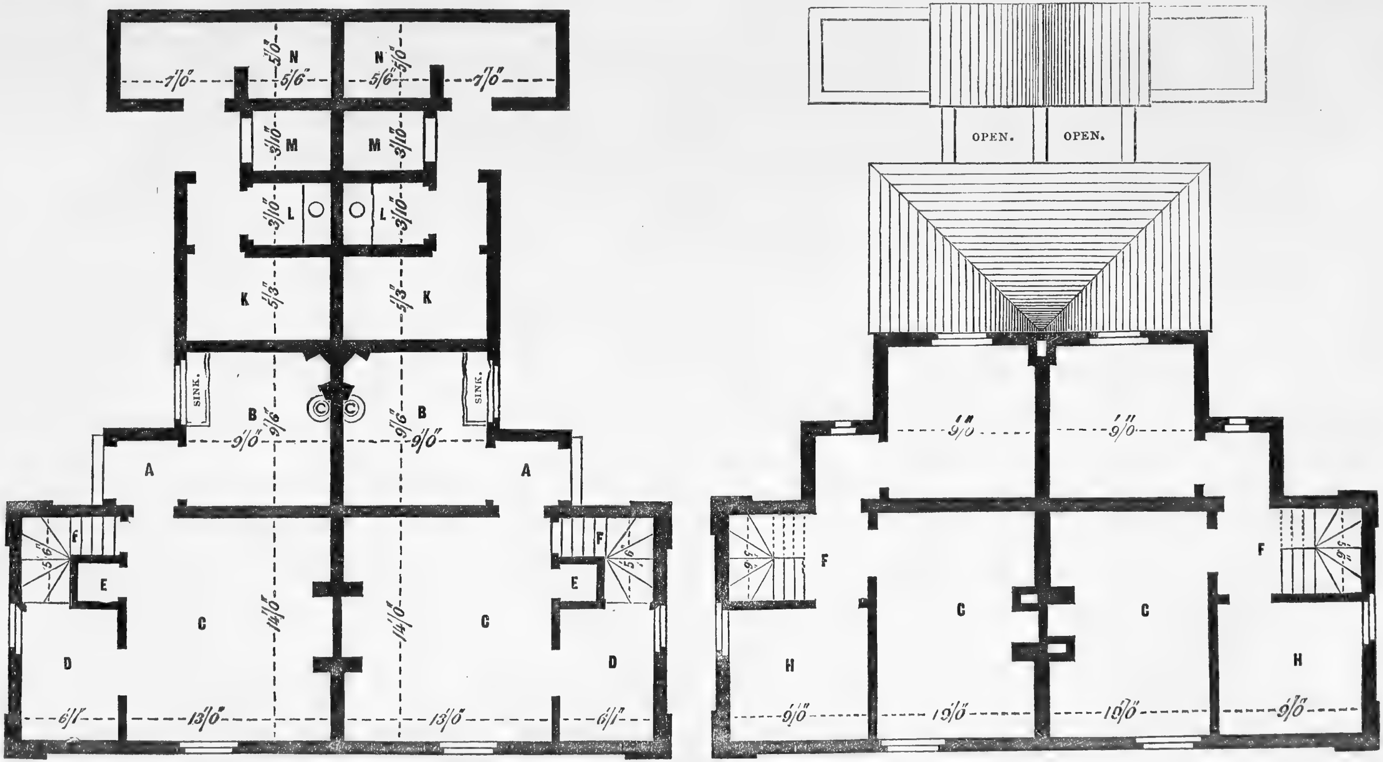
L. Privy, screened by a porch, leading to it, and to the coal-house.

M. Dust-bin.

N. Pigsty. That the cottager should keep a pig has been condemned by some; but when properly and carefully attended to, we think without sufficient reason, as we consider the pigsty an essential, as it certainly is a profitable appendage to the cottage.

The pigsty should be built by the landlord. When placed in a proper situation and drained, it should not offend either the

NO. 1. DESIGN FOR LABOURERS' DOUBLE COTTAGES.



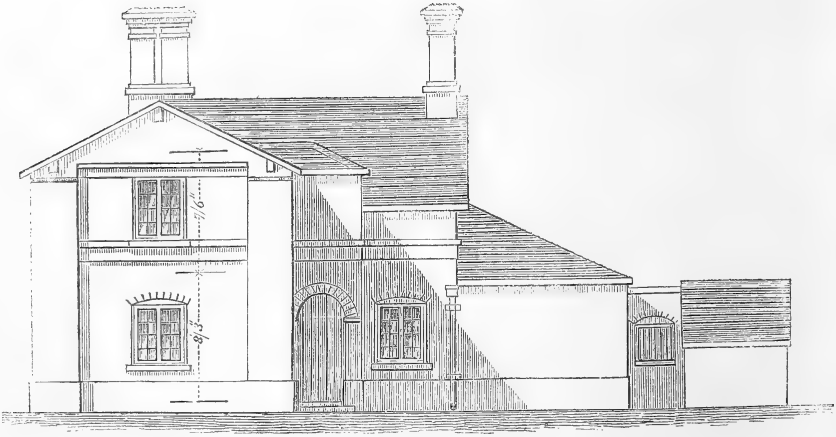
PRINCIPAL PLAN.

CHAMBER PLAN.

Scale 12 feet to the inch.

NO. 1. DESIGN FOR LABOURERS' DOUBLE COTTAGES.

FRONT.



SIDE.

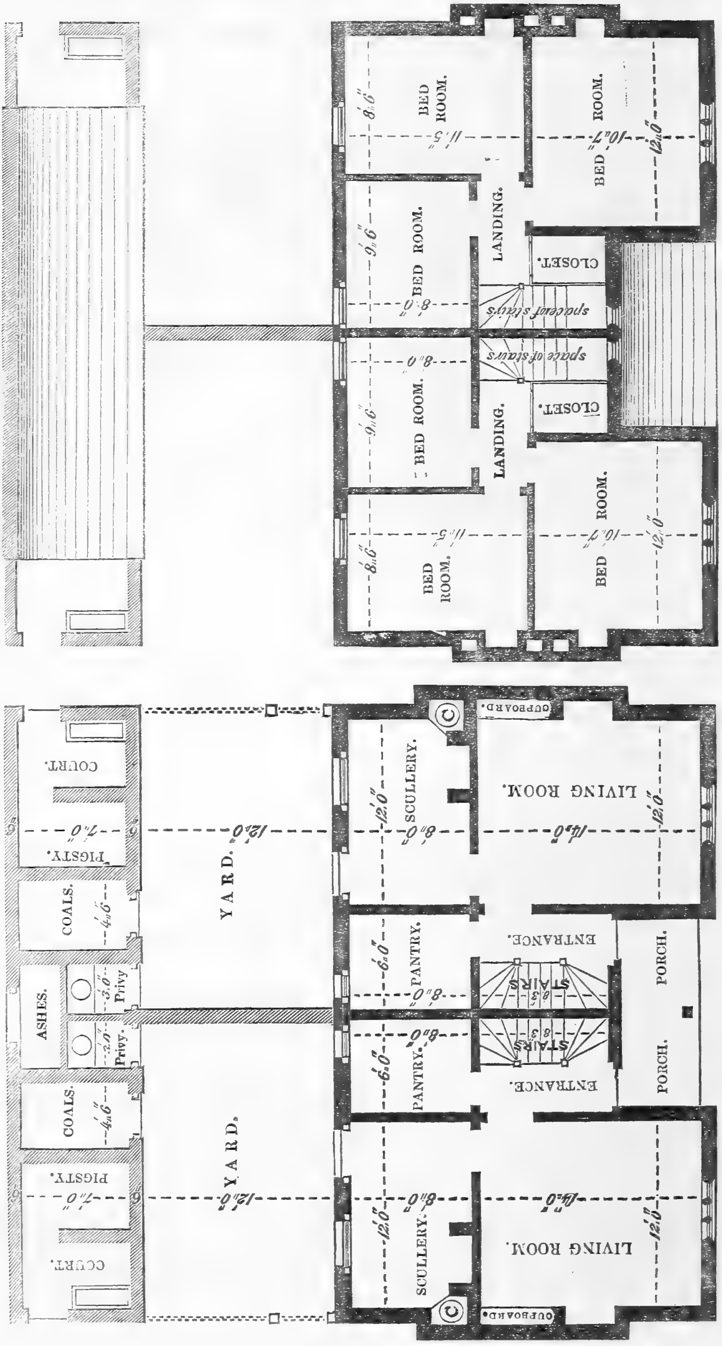
NO. 1. DESIGN FOR LABOURERS' DOUBLE COTTAGES.

FRONT.

SIDE.

Scale 12 feet to the inch.

NO. 2. DESIGN FOR LABOURERS' DOUBLE COTTAGES.



CHAMBER PLAN.

GROUND PLAN.

Scale 12 feet to the inch.

NO. 2. DESIGN FOR LABOURERS' DOUBLE COTTAGES.

FRONT.

Scale 12 feet to the inch.

eye or the sense of smelling, especially in the country (for in the crowded localities of the poor in towns it is highly objectionable), and is in no respect injurious to the health of the inmates of the cottage.

PLAN NO. 2.

Description.—The two cottages are precisely alike, and the entrance to them is beneath a shedded porch, which should front the south or south-east, and open upon a small plot of ground reserved for a few flowers and fragrant herbs.

Each cottage contains in the ground-floor a living-room, scullery, and pantry.

The living-room is 14 feet by 12 feet, and it will be observed that no encroachment is made upon this area by the projection of the fire-place, and that a useful closet is also obtained without any deduction from the dimensions of the apartment.

The scullery is 12 feet by 8 feet, and has a fire-place by which culinary operations may be carried on at seasons when the temperature may not make it convenient to have a fire in the living-room. A tinned iron or a copper pan is proposed to be placed in the recess near the fire-place, from which a flue should be built within the chimney-shaft for the purpose of conveying away the steam without the liability of its passing into other apartments.

The pantry, which is 8 feet by 6 feet, has a northern aspect, and has its entrance from the passage in preference to entering from the scullery, that the vapour occasioned by washing or similar operations may not pass into it.

A closet, in which a barrel may stand, is proposed to be made in the pantry beneath the staircase.

On the chamber-floor are three bed-rooms, respectively 12 feet by 10½ feet, 10½ feet by 8 feet, and 11 feet by 8½ feet, and on the stair-landing is a good store-closet for cheese, &c.

The detached offices consist of a pigsty, coal-house, privy, and ash-pit, which are so arranged as to form a small kitchen-yard to each cottage, one side only of which would require to be inclosed by a paled fence.

Construction.—The foundations should be dug out to a width and depth beyond what is actually required for carrying the walls of the cottage, and filled up with concrete, as a preservative from damp; and, for the same reason, the floor-line should be raised 12 inches above the level of the surrounding ground, the earth removed 18 inches beneath the ground-floors, and the space filled up with broken stones, brick-rubbish, or gravel and lime, so as to form a bed of dry materials, impervious to damp, for the floors to rest upon.

The walls may be constructed either of brick or stone, whichever material the locality affords the cheapest. If bricks are used, the walls *should not be less* than 9 inches in thickness, and 20 inches when of stone; but in either case a layer of slates, bedded in cement, should be laid upon the course of brickwork immediately below the floor-line of the ground apartments, which will effectually prevent any damp from rising in the walls.

I particularly desire to call attention to the precautions recommended to be taken against damp, as in our experience we find so many cottages suffering and prematurely decaying from its evil effects; and peculiar care is requisite for a dwelling formed without underneath cellars.

In several instances of cottages recently built, the inner walls of the ground apartments, instead of being plastered, are made of dressed bricks. This, besides being a saving in expense, has, when painted, a neat and clean appearance, and is not so liable to be injured or chipped by accident, or by the children.

The floors of the ground apartments are laid either with dressed bricks or paving-tiles, which make a clean and smooth floor.

With respect to the bed-room floors, experience has dictated a change of opinion; formerly I considered boarded floors the most comfortable, but latterly I have given the preference, as likewise the occupiers themselves, to plaster floors, as being more cleanly, comfortable, and less liable to fire.

The roofing can either be of slates or tiles, and should be made to project considerably, as another means of keeping the walls dry; and, where expense is not an object, we should recommend the asphalted roofing felt to be used under the tiles or slates, which, being a good non-conductor, would add materially to the comfort of the bed-rooms by making them warmer in winter and cooler in summer.

Windows.—Although the lattice-window looks the prettiest, yet, having comfort and economy in view, I give the preference to a window reaching to the ceiling, thereby affording perfect ventilation, with a wood frame, one half of which is made to slide horizontally; the squares to be of moderate size, consequently more easily replaced when broken.

The cottages should be spouted with cast-iron spouting. I have shown no rain-water cistern, finding the cost to be too expensive. In practice, an oil-cask, which can be obtained for about 15*s.*, will form an ample water-butt for the cottager's wants. The same remark applies to spring-water, as probably *one* well may be made to supply several cottages.

An efficient drain, for carrying off the waste water, should be laid up as far as the scullery, and the ground between the porch and the pigsty either paved or gravelled, as both the comfort and neatness of the premises materially depend upon this portion being kept dry.

Elevations.—Design No. 1. I have submitted *two* elevations; of these the first is a plain and simple cottage built of brick, and which we should recommend to be adopted where economy is the chief object of the proprietor. The estimate is formed from this plan.

The second is an ornamental cottage built of stone, of the style in which cottages have been erected near the residence of the proprietor. This elevation will of course be more expensive than the other, but has a handsome appearance. The same effect may be produced, should the design be executed in brickwork with the dressings or ornamental parts of stone.

Design No. 2. This elevation, which is characteristic of the cottage style of building, will look well when erected either in brick or stone.

Estimates.—On reference to the specifications and estimates annexed, it will be seen that a pair of cottages after our first plan, with the necessary outbuildings, will cost 295*l.* 15*s.* 11½*d.*,* and

---

* Lest the amount of these estimates should deter any gentleman from engaging in this most necessary field of improvement, I must remark that in many neighbourhoods a pair of cottages, with three bed-rooms each, may be built for a much smaller sum. A builder has lately engaged with me to build such a pair for 160*l.*; the team labour being provided for him

according to the second, 296*l.* 9*s.* 8*d.* At the first glance this will probably appear to many a large outlay, when contrasted with other estimates professing to build cottages at a much less cost.

Having had considerable experience in cottage-building, I do not think that a substantial cottage, containing the same accommodation, can be erected much, if at all, below my estimate.

Fully sensible that the more economically suitable dwellings can be erected, the more will the labourer really be benefited, by inducing the landlord to build, I have endeavoured to combine *economy* with *utility,* while at the same time not professing so much to build cheaply as substantially, and at fair remunerating prices to the builder, below and without which no work can be expected to be executed in a proper and durable manner. And here I also beg to call attention to the circumstance, that in our estimates *the total expense of cottages and outbuildings connected therewith* is given; whereas in other estimates possibly the expense of the cottage alone is stated. This, at first view, would present a startling difference; but when necessity and discomfort call for the after-addition of these, it will be found that the *final, actual expense,* will be assimilated.

It may be confidently depended upon, that the cost of the cottages, &c., *will not exceed the estimates,* the first having been deduced from the actual measurement and valuation of similar cottages built in 1848, and tested by the cost of those erected in previous years. Where materials afforded by the estate are used, the cost will be still less, but no advantage has been taken of this circumstance in forming the estimates: the materials are calculated at the current prices of the country, and we entertain no doubt that similar cottages may be built in almost any locality for

---

as in the present estimate; and, in addition, rough timber, which however on most estates may be provided from thinning of plantations, and can scarcely be called, certainly would not be felt as, an expenditure. The deal floors, &c., to be found by himself. The cost of digging rough building-stone is here 6*d.* per cubic yard, and lime is put by himself at 6*d.* per bushel. Every one now feels the necessity of improving our labourers' cottages, but as to the best plan we can only say, I fear, that we have made a beginning. Economy is necessary, because the complete work would require millions, and the means are very limited. Experience, however, will probably reduce the expense. One necessary step is, that gentlemen should become acquainted with the details of building, so as to check fraud, or at least carelessness, on the part of builders and measurers. A gentleman who attends to his own affairs may build, as I have seen, for 100*l.* what would cost another 200*l.* It also seems a formidable thing, even at the lowest estimate, to rebuild a whole village, but though many villages consist entirely of mean cottages, even they need not be renewed altogether. For two bad cottages of two rooms each, if laid into one, might make an extremely good one; and thus half the new building is saved at once. A useless barn too may be converted into an excellent pair of cottages.—Ph. Pusey.

the same cost; in some districts not so far inland, for somewhat less.

Rent.—In determining the amount of rent of the cottages before spoken of, the consideration was, how much the daily labourer, earning from 12*s.* to 15*s.* per week, could really afford to pay, rather than what he would readily have promised to give, had advantage been taken of his necessity and the utmost rent exacted. The rent charged for one of these cottages, with a garden containing about 20 perches of land, is 3*l.* 10*s.* per annum; all the taxes and rates of every description being paid by the landlord. This rent yields only a small rate of interest upon the outlay, but while our appeal is made to generous feeling more than to calculating speculation, we yet venture to say that it will bear comparison with the return upon the generality of farm-buildings.

These cottages have been erected for the *express purpose of bettering* the moral and social condition of the labourer and his family; and it will be seen in the following rules, that in accordance therewith, one of the conditions is, that the tenant shall not take in lodgers without express permission. But in cases where the proprietor takes every shilling which the cottage will let for, can he, in fairness, enforce so salutary a proviso? While, on the other hand, the occupier, from the profits obtained from lodgers, can easily afford to pay a higher rent in the one than in the other case.

In addition to the customary agreement in use upon the estate, the following condition should be strictly enforced:—

That no tenant-cottager shall take in any lodger or lodgers under penalty of forfeiting a quarter's rent for the first offence, half a year's rent for the second, and deprivation of his cottage and land for the third transgression; unless he has first obtained, in writing, the consent of the proprietor, or his agent, and of the clergyman of the parish. This permission should in no case be granted, unless the circumstances of his family, in regard to numbers, sex, age, &c., are such as, with the strictest propriety, admit of it being given.

Observation.—I have experienced considerable difficulty in enforcing this important rule relating to lodgers; and recommend that great vigilance be used, as the temptation of gain from this source outweighs the inconvenience and annoyance the lodger causes to the cottager, and endangers the re-production of all those evils from which, perhaps, he has but recently emerged.

General Remarks.—These cottages, placed in groups of three, each surrounded by a neat garden, and the centre cottage slightly in advance of the others, have a neat and comfortable appearance, rendering them agreeable features in the rural landscape; more especially when associated with the pleasing consideration that under the cottage roof dwells a family amply provided with all the requisites and conveniences of a comfortable home.

It would be unjust to the occupiers not to state my experience that the rents are punctually and cheerfully paid, and that, generally speaking, both cottage and garden are kept clean and in good order—in some instances to a much greater degree than might have been expected, contrasting the state of the dwellings they had previously occupied.

The landlord taking upon himself the payment of the parochial assessments upon cottage property rented under 10*l.* per annum, is a plan I venture strongly to recommend; thereby conferring a great boon, not only on the cottage occupier, but on the parish generally. Every parish officer can bear testimony to the difficulty of collecting the rates from the small householders—themselves frequently not far removed in *their* circumstances from the poor whom they are called upon to pay their quota to support.

SPECIFICATION *of* WORKS *to be done in the Erection of Two Labourers' Cottages.*

General Conditions.—The land-carriage of all materials will be executed without cost to the contractor; the sand and gravel required for the works will be provided from the estate.

The whole of the works are to be executed with the best materials, in a substantial and workmanlike manner, to the satisfaction of the surveyor of the proprietor, and according to the directions which may from time to time be given by him; and his certificate that the works have been so executed will be required to be produced before payment is made.

Digger's, Bricklayer's, Mason's, Plasterer's, and Slater's Works.—The surface-soil for 6 inches in depth to be removed from the site of the cottages, and the areas of the rooms to be filled up with gravel to receive the brick-paving. The soil thus removed, and also that which may arise from the excavation of the foundations, is to be distributed round the exterior, so as to give a descent in every direction from the buildings. The ash-pits and privy-vaults to be sunk 3 feet below the floor.

A bed of concrete, composed of one measure of lime and seven measures of gravel, 2 feet 6 inches wide and 1 foot 6 inches thick, to be laid throughout all the walls beneath the footings.

All the brickwork to be executed with hard-burnt kiln bricks, laid with close joints, all the return and cross joints being flushed at every course. The walls of the coal-houses, piggeries, and ash-pits to be pointed on both sides.

A course of strong slates, bedded in cement mortar, to be laid throughout every wall of the cottages, intermediately between the surface of the ground and the floor-line.

Twenty yards of drain, formed of cylindrical pipes 4 inches diameter, with socket-joints, to be laid from the sink of each cottage towards the outfall drain. Drains of similar pipes, 2 inches diameter, to be laid from the feet of the descending pipes into the larger drains.

The jambs and arches of the fire-places of the living-rooms and sculleries to be built with pressed bricks, laid in fine mortar, projecting three-quarters of an inch in front of the other walling, so as to stop the plastering. The arches of these fire-places to be turned upon iron chimney-bars.

The flues to be well pargetted with mortar mixed with cow-dung; the gatherings to be made as nearly as possible over the centres of the fire-places. The flues in the chimney-shaft above the roof to be reduced to 9 inches square, and the two upper courses to be laid in cement mortar.

Rubbed hearth-stones to be laid to the fire-places of the living rooms and chambers; brick hearths to be laid to the sculleries. Mantels and jambs 5 inches wide to be fixed to the fire-places of the bed-rooms.

The contract to include the provision and setting of two Nicholson's cottage grates with side ovens and boilers, two small chamber grates and coves, and a small range with brick cheeks and coves, and a fifteen-gallon metal boiler, with furnace-bars, door, and frame, for the scullery, of the aggregate value of 8*l.* at the first cost.

The ground-floors of the cottages are to be paved with 6-inch square paving-tiles bedded in mortar. The coal-houses and privies, ash-pits and privy-vaults, to be paved with bricks laid flat in mortar. The pigsties and courts to be paved with bricks laid edgewise in mortar. A tooled flagstone 4 feet by 2 feet, with a plain wrought-iron scraper fixed therein, to be laid in front of each porch door.

The windows to have rubbed, weathered, and throated stone sills, 10 inches by 3 inches. The outer doors to have 3-inch tooled flag sills 9 inches wide, morticed for door frames.

A 5-inch dished sink-stone, 3 feet by 1 foot 9 inches, to be fixed on brick piers in each of the sculleries, and the lead pipe and air-trap hereafter described to be let into the same.

The whole of the walls of the cottages and privies to be rendered and set fair, and the ceilings of the living-rooms and bed-rooms, the soffits of the stairs, and the external eaves and gables, to be lathed, plastered, and set fair. The ceilings of the sculleries to be pane-drawn between the joists.

The floors of the bed-rooms to be of grey floor-plaster upon laths, and to be at least 2½ inches thick.

The roofs to be covered with Bangor Countess slates, nailed with two copper nails in each to red wood battens 1½ inch by ¾ of an inch, and laid with not less than 2½ inches lap in any part. The ridges to be covered with rolled slate ridging, fixed with copper screws.

Carpenter's, Joiner's, Smith's, and Ironmonger's Works.—The works to be executed with best Memel fir timber and Petersburgh deals, excepting otherwise hereinafter directed.

A course of bond-timber 4½ inches by 3 inches to be laid in all the walls of the cottages immediately beneath the chamber floors. The lintels to be 3 inches thick, and the breadth of the wall to be supported. A sufficiency of wood bricks to be fixed to receive all casings, frames, and skirtings.

The roof over the front chambers to be framed with trussed purlins, having timbers of the following dimensions, viz., sills of trusses for purlins 5 inches by 3 inches; purlins 5 inches by 3 inches; trussing pieces 4 inches by 3 inches; rafters 3½ inches by 2 inches; wall plates 5 inches by 3 inches; ceiling joists nailed up to trussing pieces 3 inches by 1½ inch.

The roofs over the back chambers, coal-houses, and piggeries, to be lean-to roofs, having rafters 4 inches by 2 inches; wall-plates 5 inches by 3 inches; purlins 6 inches by 4 inches; and hip and valley pieces 8 inches by 1½ inch.

The ends of the rafters, and the plates and purlins, to be carried 9 inches beyond the walls, and to be faced with inch beaded boarding.

The eaves of the cottages, to have 4-inch cast-iron spouting fixed on neat metal bearers to the facia boarding, with proper falls to the descending pipes. Three stacks of 2½-inch cast-iron descending pipes, with S heads to conduct the water from the spouts, and with long elbow shoes to lead it into the drains, to be fixed in the position shown on the plan.

The floors of the front chambers to have joists 8 inches by 2½ inches, and those of the back chamber joists 5½ inches by 2½ inches; the latter to be wrought where exposed.

The staircases to have inch-treads on ¾-inch risers, upon strong carriages, the underside being bracketed for lath and plaster.

The external doors of the porches to be of 1¼-inch grooved, tongued and beaded battens with four ledges at the back, hung with 16-inch Scotch hinges to rebated and beaded frames 5 inches by 3 inches. The other doors to be of ⅞-inch battens with four ledges, hung with 15-inch cross garnets, the coal-house and privy doors having frames 4 inches by 3 inches, and the internal doors 1½-inch and half rebated jamb linings. The porches and coal-house doors to have each a 9-inch stock lock, and all other doors except the piggeries to have strong Norfolk latches. The doors of the piggeries to be ⅞-inch ledged doors, hung with hooks and bands to oak posts 5 inches square, and fastened with hasps and pins.

The windows to be 1½-inch slide sashes in solid frames, with ¾-inch linings, and 1-inch window-boards, with rounded edges to stop the plastering. Every window to have a proper screw fastening.

The living-rooms, bed-rooms, staircases, and porches, to have ¾-inch plain skirtings 3½-inches wide. Angle beads to be fixed up the chimney breasts, and all other external angles not described to be otherwise protected.

The privies to be fitted up with 1-inch wrought seat and front boards on proper bearers.

Plumber's, Glazier's, and Painter's Works.—The valleys to be lined with milled lead six pounds to the foot, 18 inches wide.

The flashings round the chimneys to be of milled lead five pounds to the foot.

A 3-inch lead pipe to be fixed from each of the sink-stones in the sculleries, and carried at least a foot into the drain.

An air-trap and grate to be fixed to each pipe.

The sashes to be glazed with thirds sheet-glass sixteen ounces to the foot.

The wood and iron-work to be painted three coats in oil colour, the woodwork being previously knotted and stopped.

ESTIMATE of Design No. 1 for Labourers' Double Cottages.

Yds.	ft.	in.		s.	d.	£.	s.	d.
88	10	0	Cube excavating and distributing soil . .	0	4	1	9	5½
31	25	0	„ concrete	1	9	2	15	10½
Rods.	ft.	in.						
12	10	0	Superficial reduced brickwork . . .	146	0	87	17	4
0	83	6	„ extra facing of pressed bricks .	0	1½	0	10	5
0	163	4	„ slate course in cement . . .	0	4	2	14	5
Yds.	ft.	in.						
80	0	0	„ 6-inch square paving-tile floor, laid in mortar	2	4	9	6	8
28	0	0	Superficial brick flat paving	1	4	1	17	4
14	4	6	„ brick on edge paving . . .	1	9	1	5	4½
			Extra to two courses of brickwork in cement to chimney heads . . . . . . No. 2 chimney bars	..		0	12	0
0	29	0	Superficial rubbed stone hearths . . .	1	0	1	9	0
0	16	0	„ tooled flagstone	0	7	0	9	4
0	10	6	„ 3-inch tooled flag-sills . . .	0	9	0	7	10½
0	10	6	„ 5-inch dished sink-stones, including brick piers, air-trap, and 3-inch lead pipe .	..		1	11	0
0	20	0	Lineal rubbed mantles and jambs, 5 inches wide	0	10	0	16	8
0	44	0	„ rubbed, weathered, and throated window-sills, 10 inches by 3 inches . . .	0	10	1	16	8
40	0	0	Lineal 4-inch drain-pipes, and laying . .	2	0	4	0	0
40	0	0	„ 2-inch ditto ditto . .	1	6	3	0	0

ESTIMATE of Design No. 1—*continued.*

Yds.	ft.	in.		s.	d.	£.	s.	d.
			No. 2 plain iron scrapers, and letting in ,, 8 mortice holes cutting ,, 2 Nicholson's cottage stoves and grates, and setting the same	..		9	18	4
381	1	2	Superficial two coats rendering	0	7	11	2	3½
152	0	0	,, two coats lath and plaster	1	1	8	4	8
66	6	0	,, two coats pane drawing	0	5	1	7	9
79	0	0	,, plaster floor	2	6	9	17	6
Squ.	ft.	in.						
17	27	0	,, Countess slating	24	0	20	14	6
0	78	0	Lineal slate ridging	0	7	2	5	6
0	240	0	Cube fir without labour, including sawing and waste	2	3	27	0	0
0	91	6	Superficial ¾-inch valley boarding	0	3½	1	6	8
0	87	6	,, ¾-inch plain casings	0	5½	2	0	1
0	15	4	,, ⅞-inch window boards	0	6½	0	8	3½
0	294	5	,, ⅞-inch ledged doors	0	7	8	11	9
0	60	0	,, 1-inch shelves and bearers	0	5½	1	7	6
0	100	5	,, 1-inch steps, risers, and carriages	0	10	4	3	8
0	29	4	,, 1¼-inch wall string housed for steps	0	10	1	4	5
0	21	0	,, 1-inch privy seat and bearers	0	8	0	14	0
0	71	6	,, 1¼-inch ledged doors	0	9	2	13	7½
0	88	0	,, 1½-inch rabbeted jambs	0	9	3	6	0
0	157	6	,, 1½-inch slide casements and frames	1	2	9	3	9
0	68	0	Lineal beaded and rabbeted door-frames, 5 inches by 3 inches	0	7	1	19	8
0	94	0	Lineal beaded and rabbeted door-frames, 4 inches by 3 inches	0	6	2	7	0
0	66	8	Lineal centres on frames	0	3	0	16	8
0	463	4	,, single mouldings	0	2	3	17	2½
0	90	0	,, angle beads	0	2½	0	18	9
0	6	6	,, deal pole handrail	0	4	0	2	2
0	43	0	,, square balusters	0	2	0	7	2
0	22	0	,, 3-inch newels	0	6	0	11	0
0	6	0	,, footing and nosing	0	4	0	2	0
0	114	0	,, cast-iron-eaves spouting and bears, fixed complete	0	7	3	6	6
0	45	0	,, descending pipes, fixed complete	0	8	1	10	0
			No. 5 heads and 3 shoes to ditto ,, 22 thumb-latches, 12 screw fastenings ,, 2 hasps and staples ,, 6 9-inch stock locks	..		3	5	6
			,, 6 pairs of 16-inch Scotch hinges ,, 16 pairs of 15-inch cross garnets ,, 6 cut brackets ,, 4 oak posts to piggery	..		2	12	4
			Labour and Nails.					
16	84	6	Superficial roofing, with trussed purlins	6	6	5	9	5½
5	69	6	,, ceiling floor	3	0	0	17	1
7	50	0	,, thorough joist flooring, wrought on the under side	4	0	1	10	0
3	33	6	Superficial stud partition	4	0	0	13	4
0	74	0	Lineal extra to hips and valleys	0	4	1	4	8
0	120	0	,, bond	0	0½	0	5	0

ESTIMATE of Design No. 1—*continued.*

Yds.	ft.	in.		*s.*	*d.*	£.	*s.*	*d.*
			No. 32 lintels Centring to 2 semi-arches	..		0	13	8
			5½ cwt. milled lead to flashings and labour to the same	26	0	7	3	0
0	102	0	Superficial glazing of thirds sheet-glass	0	6	2	11	0
211	0	0	„ three coats painting	0	7	6	3	1
			Total		£	295	15	11½

ESTIMATE of Design No. 2 for Labourers' Double Cottages.

Yds.	ft.	in.		*s.*	*d.*	£.	*s.*	*d.*
78	0	0	Cube excavating and distributing soil	0	4	1	6	0
29	0	0	„ concrete	1	9	2	10	0
Rods	ft.	in.						
10	74	0	Superficial reduced brickwork	146	0	74	19	8½
0	83	6	„ extra facing of pressed bricks	0	1½	0	10	5
0	170	0	„ slate course in cement	0	4	2	16	8
Yds.	ft.	in.						
75	1	0	„ 6-inch square paving-tile floor, laid in mortar	2	4	8	15	3
28	0	0	Superficial brick flat paving	1	4	1	17	4
14	4	6	„ brick on edge paving	1	9	1	5	4½
			Extra to two courses of brickwork in cement to chimney heads. No. 2. chimney bars	..		1	2	0
			Extra labour to weatherings of chimneys	..		2	0	0
0	29	0	Superficial rubbed stone hearths	1	0	1	9	0
0	16	0	„ tooled flagstone	0	7	0	9	4
0	10	6	„ 3-inch tooled flag door-sills	0	9	0	7	10½
0	10	6	„ 5-inch dished sink-stones, including brick piers, air-trap, and 3-inch lead pipe	..		1	11	0
0	20	0	Lineal rubbed mantles and jambs, 5 inches wide	0	10	0	16	8
0	20	0	„ rubbed, weathered, and throated window-sills, 10 inches by 3 inches.	0	10	0	16	8
40	0	0	Lineal 4-inch drain pipes, and laying	2	0	4	0	0
40	0	0	„ 2-inch ditto ditto	1	6	3	0	0
			No. 2 3-light windows with stone dressings „ 3 2-light ditto ditto „ 2 plain iron scrapers, and letting in „ 8 mortice-holes cutting „ 2 Nicholson's cottage stoves and grates, and setting the same	..		22	4	4
374	0	0	Superficial two coats rendering	0	7	10	18	2
150	0	0	„ two coats lath and plaster	1	1	8	2	6
75	0	0	„ two coats pane drawing	0	5	1	11	3
75	0	0	„ plaster floor	2	6	9	7	6
Squ.	ft.	in.						
17	96	0	„ Countess slating	24	0	21	11	1
0	91	0	Lineal slate ridging	0	7	2	13	1
0	227	0	Cube fir, without labour, including sawing and waste	2	3	25	10	9

Estimate of Design No. 2—*continued.*

Yds.	ft.	in.		s.	d.	£.	s.	d.
0	140	0	Superficial ¾-inch valley boarding	0	3½	2	0	10
0	32	9	„ ¾-inch plain casings	0	5½	0	14	8
0	15	4	„ ⅞-inch window boards	0	6½	0	8	3½
0	262	0	„ ⅞-inch ledger doors	0	7	7	12	10
0	60	0	„ 1-inch shelves and bearers	0	5½	1	7	6
0	100	5	„ 1-inch steps, risers, and carriages	0	10	4	3	8
0	29	4	„ 1¼-inch wall string housed for steps	0	10	1	4	5
0	21	0	„ 1-inch privy-seat and bearers	0	8	0	14	0
0	71	6	„ 1¼-inch ledged doors	0	9	2	13	7½
0	74	0	„ 1½-inch rabbeted jambs	0	9	2	15	6
0	157	0	„ 1½-inch casements and frames	1	2	9	3	9
0	71	0	„ 1½-inch bargeboards	0	10	2	19	2
0	68	0	Lineal beaded and rabbeted door-frames, 5 inches by 3 inches	0	7	1	19	8
0	94	0	Lineal beaded and rabbeted door-frames, 4 inches by 3 inches	0	6	2	7	0
0	46	8	Lineal centres on frames	0	3	0	11	8
0	401	0	„ single mouldings	0	2	3	6	10
0	60	0	„ angle beads	0	2½	0	12	6
0	6	6	„ deal pole hand-rail	0	4	0	2	2
0	43	0	„ square balusters	0	2	0	7	2
0	22	0	„ 3-inch newels	0	6	0	11	0
0	11	0	„ footing and nosing	0	4	0	3	8
0	84	0	„ cast-iron eaves, spouting, and bearers, fixed complete	0	7	2	9	0
0	80	0	Lineal descending pipes, fixed complete	0	8	2	13	4
			No. 6 heads and 6 shoes to ditto „ 20 thumb-latches, 12 screw fastenings „ 2 hasps and staples „ 6 9-inch stock locks	..		3	10	6
			„ 6 pairs of 16-inch Scotch hinges „ 14 pairs of 15-inch cross garnets „ 6 cut brackets „ 4 oak posts to piggery „ 1 ditto with brackets to porch	..		2	19	8
			Labour and Nails.					
15	18	0	Superficial roofing, with trussed purlins	6	6	4	18	8
5	47	6	„ ceiling floor	3	0	0	16	5½
7	54	0	„ thorough joist flooring, wrought on the under side	4	0	1	10	2
3	40	0	Superficial stud partition	4	0	0	13	7
0	92	0	Lineal extra to hips and valleys	0	4	1	10	8
0	120	0	„ bond	0	0½	0	5	0
			No. 30 lintels	..		0	10	0
Yds.	ft.	in.	6¾ cwt. milled lead to flashings, and labour to the same	26	0	8	15	6
0	98	0	Superficial glazing of thirds sheet-glass	0	6	2	9	0
198	0	0	„ three coats painting	0	7	5	15	6
			Total	..		296	9	8

XXI.—*On the Breeds of Sheep best adapted to different Localities.* By T. Rowlandson.

Prize Essay.

Profit being the ultimate object of the farmer, it is necessary, in considering this subject, to review other circumstances than the mere fact of which breed will produce the most meat on a given quantity and quality of herbage, as sheep, unlike other animals bred by the farmer, yield a certain amount of annual revenue by the sale of their fleece, prior to their final disposal to the butcher. Wool, and in some instances the sale of lambs, form prominent items in the profits derivable from sheep farms: these circumstances, combined with the fact of different breeds being more suited to one locality than another—respect being had to climate and herbage—render the solution of this question one of the most difficult, whilst at the same time it is one of the most important problems connected with the science of agriculture. In endeavouring to solve this complicated subject, it will be expedient to separate the returns which may fairly be anticipated from wool, meat, and lambs into separate heads, prior to summing up the whole. There are certain districts, however, where the question of wool may fairly be set aside, long experience having proved that only particular species of sheep are adapted to subsist on the dreary wastes where such breeds are only found: the question in such places being not as to the return which may be derived from wool, but will the animals live at all; in these cases the wool forms a very secondary consideration. Notwithstanding the character of the herbage and climate found on the wide spreading moors and craggy hill tops of North and South Wales, Cumberland, Westmoreland, Durham, the Highlands and Western Islands of Scotland, Wicklow, Kerry, Mayo, and Galway in Ireland, is much alike, the breeds are as dissimilar as the countries named are geographically distant, several of which are greatly inferior to others living under like conditions, which point will be more dwelt upon in its proper place; we shall now proceed to investigate the various bearings which the quantity and quality of the wool of different breeds of sheep have upon the profits of the sheep-farmer.

Wool has for centuries been esteemed our staple production, and was the original source of our greatest manufacture,* emblematical of which the Lord High Chancellor's seat in the

---

* In the beginning of the reign of Henry VIII. flourished at Newbury, in Berkshire, John Winchcomb, commonly known as Jack of Newbury one of the greatest clothiers that ever existed in England prior to the use of the steam-engine in forming textile fabrics. He kept 100 looms in his house; and in the expedition to Flodden Field, marched 100 of his own men, armed and clothed at his own expense.

House of Lords is formed of a wool-pack covered with velvet. A large portion of the revenues of our earlier kings was derived from an export duty on wool and woollen cloths. Smith, in his "History of Wool and the Woollen Manufacture," records the prices of English wools in 1341, for home use and exportation—it is valuable not only as giving the price of wool, but the relative value of wools grown in different districts at that period.

	To the Staple for Home use.										For Exportation.					
	Per Sack.			Per Stone.		Per Sack.			Per Stone.		Per Sack.			Per Stone.	
	£.	s.	d.	s.	d.	£.	s.	d.	s.	d.	£.	s.	d.	s.	d.
Salop	6	6	4	5	0	7	6	4	5	9	9	6	4	7	3½
Ditto, Stuffs, including Leicester	5	6	8	4	2	6	6	8	4	11	8	6	8	6	5½
Nottingham	4	13	4	3	7	5	13	4	4	4	7	13	4	5	10½
York and Rutland	4	10	0	3	5½	5	10	0	4	2½	7	10	0	5	9
Derby	3	3	4	2	5	4	3	4	3	2	6	3	4	4	8½
Cumberland and Westmoreland	2	13	4	2	1	3	13	4	2	10	5	13	4	2	4½

Anderson also, in his "Origin of Commerce," gives a nearly similar list of prices of some of the wools in 1343, when exported—Shropshire, 9*l.* 6*s.* 8*d.* per sack; Oxford and Staffordshire, 8*l.* 13*s.* 4*d.*; and Leicester, Hereford, and Gloucester, 8*l.*, the lowest price being that of Cornwall, which is set down at 4*l.* In 1342, the king (Edward III.) sent a great number of sacks of wool to Cologne, in order to redeem Queen Philippa's crown, which was pawned there for 2500*l.*; the average price of that wool was 1*s.* 3½*d.* per lb. In 1354, the exports had risen to 31,651 sacks, equal to 8,356,864 lbs., on which Edward levied duties to the amount of 277,606*l.* 2*s.* 9*d.*

At this period, the first mention is made of exported manufactured goods, viz. :—4774½ cloths, of the value of 40*s.* each, and also 8061 pieces of worsted goods, valued at 16*s.* 8*d.* the piece; on the other hand, there were imported 1832 cloths of the value of 6*l.* each. The preceding extracts are important as indicative of the fact that the finest cloths were imported, whilst no worsted goods were needed from abroad; indeed, the quantity and value of the latter which were exported show that their manufacture in this country had arrived at a very high degree of perfection, as compared with the fine cloth manufacture, and further shows that a large portion of the wools exported were of the fine or short description: in fact, the fine wool of Britain was celebrated in the time of the Romans, and that luxurious people had British wool manufactured into the finest description of cloth, such as robes, &c., which were only used on festive and other celebrated occasions: these circumstances, together with the fact that in 1172, Henry II., by statute, ordained that Spanish should not be mixed with English wool; and in 1186, the prohibition of Spanish wool was more strictly enforced, and it was ordered, that all cloth of British manufacture found made of Spanish wool, or in which that material should be mixed, should be burned in the presence of the Lord Mayor of London. Now it is well known to manufacturers that foreign wool may be mixed with those of British growth, with a decided advantage to both; this the manufacturers of that period appeared fully to understand. Such mixture not appearing equally beneficial to the wool grower, the practice was ordered to be prohibited in so far as a statutory enactment could enforce the prohibition.

The preceding details, coupled with the fact that when Henry III. permitted the importation of fine cloths, the price of home grown wool declined and stocks accumulated, show clearly that fine wools which competed with those of this country were grown on the Continent; they also show that wool of sufficiently fine quality for making broad cloths was grown in this country. The disuse of such in making English broad cloth has arisen from two causes,—first, a slight deterioration in the quality of fine British wool for fulling purposes, and secondly, the increased attention paid in recent years to the growth of wool in Spain, Germany, Australia, &c., where the efforts in improving the fineness of the fleece has been seconded by natural causes,—warmer and drier climate, a somewhat arid soil, and consequently not so luxuriant pasture. Without a thorough knowledge of this fact, persons unacquainted with the woollen manufacture may be permitted to doubt that such a thing is possible as that, in the course of two or three years, the fleeces of a flock of the same breed, bred on the same land, should so far deteriorate as to become unfit for fulling purposes, and this solely attributable to the fact of a greater variety and luxuriance of food being given to them; yet such statement is strictly true; on this and several other points most valuable evidence was given before the Committee of the House of Lords with reference to the wool duties in the year 1828, from which we shall draw some copious extracts illustrative of the changes which have taken place in the growth of British wool and manufacture of British woollen fabrics. Mr. Bull stated that

"There are not many more sheep kept in Sussex than formerly, but the quantity of wool has increased."

Mr. Fison,—

"The farmers now return their sheep, as they are accustomed to call it, much quicker—that is, fatten and sell them at earlier periods. The farmers formerly were not able to fatten and sell their sheep before they were two or three years ol, b ut under the improved system of agriculture, they fatten and sell them at from one to two years old, so that there has been a gradual deterioration of wool since 1793."

With reference to the question respecting *the change which is alleged to have taken place in the weight of the carcase of the sheep, in the quality of the fleece and in its usefulness for the purposes of manufacture,* it was stated by Mr. William Pinkey of Salisbury Plain,

"that he did not think the quality of wool from *our* Southdown sheep has deteriorated within the last four or five years. It is generally considered that our wool, since the introduction of Southdown sheep, is of a finer description than that grown upon the Wiltshire sheep, which preceded them, and which were larger: we could not keep so many Wiltshire sheep on the same quantity of land."

Mr. J. Ellman, jun.—

"I think the quality of the wool from our Southdown flock is as good as it was six years ago; each sheep produces upon the average about three pounds of wool. I keep my sheep better than they were kept before, and I fatten my sheep now, which I did not before, and of course the fleeces are heavier."

It may be observed that farmers may most conscientiously believe that no deterioration has taken place in the quality of their fleeces for manufacturing purposes, yet still such may be the fact; the choice and assortment of wools for the finer kinds of goods is a much more delicate matter than is usually imagined. The whole of the evidence given by the agricultural interest went to show that no deterioration of Southdown wool had taken place, the only cases of alleged improvements were adduced by Mr. Thomas Duke of Sussex, who considered the wool of the Duke of Richmond's flock * to be a great deal better than it was, and those of the Duke of Norfolk and of Mr. Huskisson were no worse than they were formerly.

The evidence of all the woolstaplers and manufacturers was conclusive as to the deterioration: this part of the evidence abounds with so much interesting information, and will be almost totally novel to farmers, induces us to give some copious extracts.

Mr. William Nottage, fellmonger of Bermondsey, stated—

"that in the year 1800 he was ordered to make a trial of several different sorts of skins as to their produce. Southdown skins slaughtered in London, when at full maturity, produced about 3¼ lbs. per skin; now they are estimated to produce from 4 lbs. to 4¼ lbs.; and we find a corresponding increase in weight, from the farmer's fleeces, generally in Kent and those parts. Where the weight has increased there is always a less quantity of fine wool and a larger quantity of coarse. Considered there is a great deal less fine wool grown now than there was twenty years back;

---

* If this should ever meet the eye of the Duke of Richmond, that patriotic nobleman could afford, most probably, some interesting information respecting the cause of this improved quality.

but the sheep which are now kept by farmers generally he considered an improved sheep—improved in size, and in the produce as to quantity, as applicable to carcase, and also more wool, but not of so fine a quality. In sorting wool in that part of the county of Kent, at the time that fine wool bore a good price, used to make about one-eighth of our best quality of English wool; now (1828) we do not set a basket for it at all; the quantity is so small we do not throw it out, we do not separate it. Had been in the habit for several years of purchasing the fleeces of particular flocks; there is one flock of Southdown wool in the county of Sussex that he has had from the year 1792 up to 1828; and in the year 1814 the fleeces ran, some fourteen to the tod, and some few fifteen, and some few sixteen and seventeen. Had some wool last year and it ran eleven and a half fleeces to the tod all the way through, so that there has been an increase of weight of probably one-third, and of course a deterioration of quality; the quantity of coarse wool has greatly increased from that description of sheep. As far as his observation goes, wherever inclosures take place and the land becomes better cultivated, they keep a better kind of sheep, and Southdown sheep of a good size are always more marketable than of a small size. There are some few Southdown flocks now, the wool of which is as good as ever it was, but generally they are deteriorated."

Mr. William Cunnington, woolstapler, Wiltshire, principally purchased Southdown wool, and gave the following particulars of Southdown wool assorted:—

	List.	Wash.	Abbs.	Drt.	Head.	Super.	Choice.	Prime.	Pick.
Flower Farm:	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1812 . .	2	68	20	11	20	56	202	412	43
1818 . .	16	117	70	52	86	160	323	915	170
1822 . .	62	95	134	93	288	274	309	665	19
Aytons:									
1811 . .	23	98	41	21	50	131	305	387	127
1820 . .	52	106	62	65	145	213	329	468	..
1822 . .	102	52	55	57	120	200	272	392	..
Deveriest:									
1823 . .	110	209	353	369	658	614	800	848	16
1827 . .	96	93	397	374	758	956	636	444	..
Nowlson:									
1811 . .	..	56	27	10	16	21	95	247	493
1816 . .	11	143	49	26	34	98	242	851	112
1821 . .	42	104	47	51	79	128	230	444	..
Cross:									
1817 . .	23	100	55	67	59	159	386	946	72
1825 . .	51	83	190	188	425	322	308	272	8
Powell:									
1815 . .	7	112	64	40	67	148	347	875	90
1827 . .	52	52	218	94	376	273	411	705	none.

"In the year 1815 one of those portions of wool, the gross weight of which was 1006 lbs., made the best quality in sorting 60 lbs.; and in the year 1827 the same wool, grown on the same farm, made none of that quality. From the year 1811 till 1822 lived at Heytesbury, and sold the whole of my wool, or nearly so, to the Frome Market; and when I removed to where I now reside, near Pewsey, I sold then the greater portion of my wool still in Frome; but within the last two years the greater part has been sent to Rochdale, and that district, where it is used principally for flannels, baizes, and goods of that description. Attributed that alteration to the great deterioration of quality, and to the taste of the country; the public will not wear the coarse Southdown cloths, they are so very coarse. Attribute the deterioration to the improved system of agriculture.

"The farmers are in the habit of growing so much more artificial food than formerly, and paying greater attention to the size of the sheep than to the quality of their wool; they have now much larger framed sheep than they had fifteen years ago."

Mr. John Brooke, of Honley, manufacturer, stated—

"That he had purchased the Duke of Norfolk's clip in Norfolk and the Messrs. Ellmans' of Sussex, viz., Mr. E., junior's, clip from 1817 to 1822, and Mr. E., senior's, from 1817 to 1821; the latter clip was

In 1817 . . .	384 lbs.	77 prime.	84 choice.	65 super.
1821 . . .	416 ,,	6 ,,	32 ,,	126 ,,

"Mr. Ellman, junior's clip had a similar result. The greater part of the fine Southdown wool was used in the manufacture of livery cloth."

That a deterioration in the character of Southdown wool for felting purposes has taken place there cannot be a question, notwithstanding which the depreciation in value has been much greater than the depreciation of quality: this has arisen partly from an increased taste for wearing fine cloths having thrown the Southdown wool entirely out of the market as a clothing wool, and partly from the shortness of the staple of Southdown wool not adapting it for combing purposes; improvements in machinery have, however, been effected, which combined with the constantly annual increasing length of the staple of Southdown wool, causes it now to be pretty extensively used for fine flannels, &c., and will no doubt in a few years become one of our most valuable, and at the same time one of our most extensive combing wools; on this point I shall have something more to state hereafter as corroborating in some measure what has been just stated, viz., that the depreciated value of Southdown wool has arisen partly from its short staple not adapting it for combing purposes. It was stated by Mr. William Nottage, in the evidence already so extensively quoted, that wool from the Southdown sheep, crossed with a larger breed and fed on enclosed lands, having a longer staple, meets with a readier sale, and is worth more money than fine Southdown wools of *better quality*.

	s.	*d.*
In the year 1800 a *prime Leicester* skin in the wool weighed 20 lbs., the wool of which was 8½ lbs., pelt 13½ lbs.; the carcase supposed to be about 14 stone: the skin was worth	7	0
A middling Lincoln skin. The wool was 8 lbs., the pelt 9 lbs., the carcase 12 stone: the skin	5	8
A Hereford skin. The wool was 5 lbs., the pelt 10 lbs., the carcase 14 stone: the skin	6	6
A Southdown skin. The wool 3¼ lbs., the pelt 7¼ lbs., the carcase 10 stone: the skin	5	4
A Norfolk skin. The wool 3 lbs., pelt 7 lbs., carcase 8 stone: the skin	4	9
Shortlings	1	2

The following valuable table of the prices paid by Mr. Nottage in Kent, in the spring, for wools, indicates the gradual change which has taken place in the relative values of Southdown and long or combing wool:—

	Southdown, per lb.		Marsh. per lb.			Southdown, per lb.		Marsh, per lb.			Southdown, per lb.		Marsh, per lb.	
	s.	*d.*	*s.*	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*	*s.*	*d.*
1792	1	2	0	11½	1805	1	9	1	4	1817	1	7	1	3
1793	0	11½	0	9½	1806	1	11	1	2½	1818	2	0	2	0
1794	1	0	0	9½	1807	1	10	1	2	1819	2	0	1	3
1795	1	3	0	10	1808	1	9	1	0	1820	1	5	1	4
1796	1	4	0	9½	1809	2	1	1	9	1821	1	2½	1	1
1797	1	3½	0	9½	1810	2	8	1	4	1822	1	1	0	11
1798	1	2½	0	9½	1811	1	9	1	1	1823	1	2½	1	0
1799	1	7½	1	0	1812	1	6½	1	1½	1824	1	0	1	1
1800	1	5	1	0½	1813	1	7½	1	3	1825	1	4	1	4
1801	1	5½	1	0½	1814	2	0½	1	9	1826	0	10	0	11
1802	1	7	1	2	1815	2	1	1	10	1827	0	9	0	10½
1803	1	7½	1	1½	1816	1	6	1	3	1828	0	9	0	11½
1804	1	9	1	3										

The preceding lengthened statements respecting the price, &c. of wool, have been made in order to demonstrate, as it does most clearly, that it is now impossible to seek an increased money return from Southdown sheep by its increased price as a felting wool: the attention paid on the Continent and Australia to the finer qualities of wool will for ever render abortive attempts to rival those countries, either as regards price or quality, particularly as the wool-grower in this country has a climate to contend with adverse to the growth of the finer qualities. I state this advisedly, notwithstanding I hold a very strong impression that the major part of the broad and finest cloths were almost exclusively manufactured from British wool from a period commencing with the Christian era up to the thirteenth century, and that a large portion of the wool exported during that period was of the finest description. The account previously given of the price of Shropshire wool, the highest in England, is in a great degree confirmatory of this opinion, and was composed most probably of the fleeces of the more common sheep, which were so long the pride and boast of Shropshire, producing as they did the finest wool in England, superior to the Ryelands. The Morfe sheep have small horns, with speckled dark or black faces and legs; their general characteristics are more or less to be found amongst all the short-woolled breeds throughout the British European dominions, whether we search amongst the Kerry, Wicklow, and Galway mountains in Ireland, the Ryelands, Southdown, and Herdwicks in England, or the diminutive race found in the Orkneys and Shetland Isles. The Herdwicks may be classed amongst the middle woolled species: this arises in a great measure from the great quantity of kempy locks which compose the fleece of this breed: the fine wool which is found on the neck and underneath the kempy covering, together with their general aspect, indicate one generic origin. Whether the long-woolled sheep, such as the Cotswold, Lincoln, Teeswater, &c., are descended from the same common stock, viz., the short-woolled variety, or the reverse, is a question that can never be satisfactorily answered; that a change of character may arise from depasturing such on rich plains and alluvial soils through a series of ages without having the blood intermixed with the smaller breed and short-woolled variety is highly probable. The change now going on in the character of the wool from the improved Southdown sheep is an apt illustration of such an alteration which it would be well if the breeders of Southdown stock would direct more attention to, as Southdown wool at the present time is not fit for carding, neither is it well adapted for the more valuable kinds of combing. If the staple could be lengthened, and consequently a heavier fleece produced without deteriorating the present fine, smooth, silky character of the fibre, the Southdown would then yield a money return equal to that of our heaviest long-woolled sheep. By judiciously crossing with a Cotswold, and an occasional dash of the Anglo-merino, I feel persuaded that such a desideratum might be obtained, in which case the carcase would be increased and the wool at the same time be adapted for the manufacture of cashmeres, challis and all the finer kinds of manufactures, where silk and worsted are combined in one fabric, by which means it would realise as high a price as any of the finest German wools, with the exception of a very small quantity selected with particular care for the purpose of forming the bodies (known as felts) of the finest beaver hats. A wool of the description named would find a ready market when the finest felting wools are comparatively unsaleable: the vacancy in this species of wool is now in a great measure filled up by Alpaca* wool from South America, but there are many purposes for which Alpaca wools are unsuitable, and for which a combing wool such as described would be well adapted.

The Duke of Bedford made several experimental trials on the relative values of different descriptions of sheep, on some of which the greatest amount of care and attention was paid, and were the longest continued of any similar experiments made in England. The following is a synoptical table of the results of one of these experiments made on four different breeds, viz. twenty, each of Southdowns, Leicesters, Worcesters, and sixteen of Wiltshire: the experiment was only carried on with sixteen Wiltshires, as they were found to consume as much food as twenty of the other breeds:—

---

* An animal of the Llama tribe which inhabits the mountains of Peru. The substance here alluded to possesses, in some degree, the joint properties of goats-hair, silk, and wool.

A GENERAL VIEW of the INCREASE of WEIGHT to the several PERIODS.

	Weight, November 19, 1794.	Weight, February 25, 1795, and Loss in 14 Weeks at Turnips.	Weight, May 13, 1795, and increase in 11 Weeks at Turnips and Grass.	Weight with their Wool, July 3, 1795, and Increase in 7 Weeks at Grass.	Weight, Oct. 15, 1795, and Increase in 15 Weeks (Wool omitted) at Grass.	Weight, February 16, 1796, and Increase in 18 Weeks at Turnips.	Increase in the last 51 Weeks; 1 Year's Wool; Value of Flesh, at 7½*d.* per lb., and the Wool.	Sold at about 2 years old. Price of Flesh, and 1 Year's Wool.
Twenty Southdowns Average weight alive Ditto dead (as 20 is to 12)	1,933 lb. 8 oz. 96 10 58 0	1,739 lb. 3 oz. 87 0 52 3	1,862 lb. 14 oz. 93 2 55 14	2,212 lb. 13 oz. 110 10 66 6	2,572 lb. 10 oz. 128 10 77 3	2,734 lb. 12 oz. 136 13 82 1	3st. 5lb. 14 oz. Wool, 4 12	£. 2 7 0 0 6 2¾
Ditto in stones of 8 lb. Loss and gain (dead weight) Wool 37*s.* per tod of 28 lb.	7 st. 2 lb. 0 oz. ..	6 st. 4 lb. 3 oz. 0 5 13	6 st. 7 lb. 14 oz. 0 3 11	8 st. 2 lb. 6 oz. 1 2 8	9 st. 5 lb. 3 oz. 1 2 13	10 st. 2 lb. 1 oz. 0 4 14	£. 0 18 8½ 0 6 2¾ £. 1 4 11¼ Per week, 5¾	£. 2 13 2¾
Twenty Leicesters Average weight alive Ditto dead (as 20 is to 12)	1,954 lb. 0 oz. 97 11 58 10	1,685 lb. 0 oz. 84 4 50 9	1,711 lb. 2 oz. 85 9 51 5	2,065 lb. 7 oz. 103 4 61 15	2,505 lb. 4 oz. 125 4 75 2	2,769 lb. 4 oz. 138 7 83 1	4 st. 0 lb. 8 oz. Wool, 6 9	£. 2 10 8 0 4 8
Ditto in stones of 8 lb. Loss and gain (dead weight) Wool 20*s.* per tod.	7 st. 2 lb. 10 oz. ..	6 st. 2 lb. 9 oz. 1 0 1	6 st. 3 lb. 5 oz. 0 0 12	7 st. 5 lb. 15 oz. 1 2 10	9 st. 3 lb. 2 oz. 1 5 3	10 st. 3 lb. 1 oz. 0 7 15	£. 1 0 3¾ 0 4 8 £. 1 4 11¾ Per week, 5¾	£. 2 15 4
Twenty Worcesters Average weight alive Ditto dead (as 20 is to 12)	1,855 lb. 8 oz. 92 12 55 10	1,654 lb. 0 oz. 82 11 49 10	1,827 lb. 8 oz. 91 6 54 13	2,221 lb. 6 oz. 111 1 66 10	2,717 lb. 12 oz. 135 14 81 8	2,863 lb. 10 oz 143 3 85 13	4 st. 4 lb. 3 oz. Wool, 6 14	£. 2 4 9½ 0 5 1½
Ditto in stones of 8 lb. Loss and gain (dead weight) Wool 21*s.* per tod.	6 st. 7 lb. 10 oz. ..	6 st. 1 lb. 10 oz. 0 6 0	6 st. 6 lb. 13 oz. 0 5 3	8 st. 2 lb. 10 oz. 1 3 13	10 st. 1 lb. 8 oz. 1 6 14	10 st. 5 lb. 13 oz. 0 4 5	£. 1 2 7½ 0 5 1½ £. 1 7 9 Per week, 6½	£. 2 9 11
Sixteen Wiltshires Average weight alive Ditto dead (as 20 is to 12)	1,733 lb. 8 oz. 108 5 65 0	1,508 lb. 6 oz. 94 4 56 9	1,690 lb. 12 oz. 105 10 63 5	2,036 lb. 11 oz. 127 5 76 6	2,418 lb. 4 oz. 151 2 90 11	2,571 lb. 14 oz. 160 12 96 7	4 st. 7 lb. 14 oz. Wool, 4 2	£. 2 6 4¾ 0 5 5½
Ditto in stones of 8 lb. Loss and gain (dead weight) Wool 30*s.* per tod.	8 st. 1 lb. 0 oz. ..	7 st. 0 lb. 9 oz. 1 0 6	7 st. 7 lb. 5 oz. 0 6 11	9 st. 4 lb. 6 oz. 1 5 1	11 st. 2 lb. 11 oz. 1 6 5	12 st. 0 lb. 7 oz. 0 5 12	£. 1 4 11½ 0 5 5½ £. 1 10 5 Per week, 7	£. 2 11 10¼

In order to ascertain the consumption of turnips, they were weighed from October 19th, 1795, to February 14th, 1796, as they were given to the sheep, and the remnants not eaten also weighed and deducted: the following is the result:—

Sheep's Food—17 Weeks.	Twenty Southdowns.	Twenty Leicesters.	Twenty Worcesters.	Sixteen Wiltshires.
	lbs.	lbs.	lbs.	lbs.
Turnips given	54,036	54,036	54,036	54,036
,, taken away	1,812	2,001	1,361	1,189
,, eaten	52,224	52,035	52,675	52,847
Hay given	64	54	68	76
Turnips, per week	3,072	3,061	3,098	3,108
Hay, ditto	4	3	4	5
	Weeks. day.	Weeks. day.	Weeks. day.	Weeks. day.
A good acre of turnips, supposed to weigh 14 tons, or 31,360lbs., will keep 20 sheep, with the hay as above	10 1	10 1	10 1	8 1

Between December 4th, 1794, and February, 1795, at which period the whole of the lots receded in condition, the consumption of turnips was as follows:—

Southdowns	10,945 lbs.
Leicesters	11,500 ,,
Worcesters	11,498 ,,
Wiltshires	11,518 ,,

All the four lots had 120 lbs. of hay each.

From the above it appears that, notwithstanding the great deterioration in condition of the Leicesters as compared with the Southdowns, and from which the former were so long in recovering, still the Leicester yielded an equal money return per week with the Southdowns, and would have exceeded the latter if the wool were valued at present prices. The Wiltshire return is also higher than it would be according to the present prices of wool; it was not necessary to alter the price named, viz., 7½*d.*, as the same price being carried through all the lots made the comparison hold good throughout. In order to make the experiments still more complete and more satisfactory, one from each lot was chosen; the second best as nearly as could be, for killing and weighing; and that the question of bone might not depend on any general assertions, they were ordered to be carefully kept and weighed from every joint as eaten. The following is the result:—

	Southdown Sheep.		Leicester Sheep.		Worcester Sheep.		Wiltshire Sheep.	
	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.
Weighed alive . . .	155	0	152	0	161	0	175	0
Skin	17	8	20	0	23	0	23	0
Fat	13	2	11	8	12	8	13	8
Head and pluck . . .	10	8	9	6	12	0	14	0
Entrails	13	4	11	2	15	0	17	10
Blood	5	14	6	0	8	0	8	2
Four quarters . . .	92	6	92	0	89	0	97	0
	152	10	150	0	159	8	173	4
Waste; viz. urine and evaporation	2	6	2	0	1	8	1	12
Bones, clean	6	5¾	5	9	6	0	9	8
Fat, with the kidnies in . .	8	6	5	1	6	12	4	3½
Kidnies	0	4¾	0	4	0	5	0	5
Proportion of live and dead weight . . .	20 gives 11¾		20 gives 12		20 gives 11		20 gives 11	

By which it appears that a new Leicester, which weighs about 11½ stones, carries as much flesh, when freed from the bones, as a Wiltshire of 12 stones, and would consequently have made a greater profit than the Wiltshire when that half stone has been deducted and the difference in the value of wool accounted for. It is a very singular circumstance, in connexion with the preceding experiment, that the Leicesters should have eaten a greater quantity of food between December 4th, 1794, and February 24th, 1795, than the Southdowns, yet should have decreased in weight between November, 1794, and the latter date, so much as 269 lbs. live weight, while the Southdowns only decreased 194 lbs. weight. On the contrary, between October, 1795, and February, 1796, the Southdowns consumed a trifling weight more food, and increased only 162 lbs. in weight, whilst the Leicesters increased 264 lbs. The circumstance is the more remarkable, as the decrease and increase occurred at corresponding periods in their respective years. It has, perhaps, arisen in the following manner: the latter end of 1794 and the commencement of 1795 has probably been cold and frosty, accompanied by bleak, windy weather. In such case all the sheep might be expected to suffer as they did; but the Leicester, as being most obnoxious to such influences, suffered the most of any. On the other hand, if the termination of the year 1795 and the commencement of 1796 had been wet, but mild, such weather would be equally obnoxious to the Southdown. The experiments just detailed have led us rather prematurely to enter on the discussion of the question respecting the merits of the Leicester and Southdown. As these two classes of sheep occupy by far the largest share of the attention of agriculturists at the present day, a better opportunity will not perhaps be found to discuss their respective merits. The respective advocates of the breeds under notice struggle not only for the predominance of their favourites, but would appear, from their earnest advocacy, not content with anything less than the absolute dominion of all the arable and grazing land being ceded to their pets. In this I believe both sides to be wrong. From observations carefully made, I feel convinced that ordinary Leicesters will succeed better, return a greater amount of money to the farmer in less time and on a smaller amount of food, both of flesh and wool, than an ordinary Southdown, if they are fed on a pasture fairly succulent, up to a rich one, or on artificial food, such as rape, Swedes, &c.; and this will be still more distinguishable if the experiment is made in a moist country. On the contrary, if the experiments were made on wide, open, bleak downs, with a scanty herbage, where the animals will be compelled to travel far for their food, exposed at the same time to cold, cutting winds, the merits of the Southdown would be found decidedly to preponderate. In passing an opinion on this matter I do not include the merits of the Southdown for folding, that being a practice, which, however indispensable it might have been in former times, is now questionable, since the benefit derived by folding on arable land is more than balanced by the loss sustained on the sheep and pastures.* Three hundred weight of guano will be a much better dressing to an arable field than the best folding; and as regards treading the land, in order to render it firmer, the roller and seam-presser will be much more effectual. To sum up this matter in a few words, regard being had to the climatic circumstances already alluded to, Southdowns will be found most advantageous on dry soils much exposed to the bleak winds of winter and the drought of summer, the herbage of such places usually consisting of varieties of rye-grass (*Lolium perenne*), bent (*Agrostis*), sheep's fescue (*Festuca ovina*), sweet-scented vernal-grass (*Anthoxanthum odoratum*), hard fescue (*Festuca duriuscula*), crested dog's-tail (*Cynosurus cristatus*), annual meadow-grass (*Poa annua*). With such herbage, and on arid downs and plains, the Leicester would cut but a sorry figure; the Southdown, however, will do well in these places. In stating this, however, it must be clearly understood that ordinary Southdown sheep—not the splendid prize animals exhibited occasionally by the Duke of Richmond, Jonas Webb, and — Grantham, Esqrs.: such animals must be fed equal to Leicesters.

On pastures where several of the above grasses, such as rye-grass, sweet-scented vernal, hard fescue, crested dog's-tail, &c., are accompanied more or less with cocksfoot (*Dactylis globerata*),

---

* Upland downs, however, on a farm would probably form one exception.—Ph. P.

Timothy grass (*Phleum pratense*), meadow fescue (*Festuca pratensis*), meadow foxtail (*Alopecurus pratensis*), white and red clovers, &c., the Leicester will be found to flourish; and if the grasses consist in a great degree of timothy, meadow foxtail, and cocksfoot, a still heavier animal, the long-woolled sheep, may be fattened profitably.

I consider there are two causes which may be assigned for the increasing adoption of Leicester sheep in districts where, until a recent period, the Southdown knew no rival. One is the gradually increasing practice of breaking up down-land and sandy pastures in the south of England, for the purpose of converting the same into arable cultivation, and the adoption of turnip-husbandry. For this description of husbandry I think it will be conceded that the Leicester has no rival; added to which is the circumstance of the greater annual return for wool made by Leicesters, in consequence of the great change which has taken place in the relative prices of short and long wool. Our long wools, for combing, have ever stood unrivalled. Besides its longer staple (foreign wool being about 5 inches, whilst Lincolnshire is 8 inches, sometimes 9 or 10 inches in length), its much stronger and more endurable fibre, has caused the foreign demand for long wool to continue after the call for fine felting wool has ceased. The French buy a considerable quantity of wool in Ireland, for the purpose of manufacturing their mixed stuff fabrics, the soft quality and long staple of the superior kinds of Irish sheep rendering the wool well adapted for the purposes intended, but which would fall infinitely inferior to such a wool as we presume might be engrafted on the Southdowns. In the opinion that a superior combing wool might be produced or engrafted on one or more of our native stocks, I am happy in having to record that the late Lord Western, than whom no man paid greater attention to the growth of fine wools, concurred in opinion, for he observed in a letter to the late Earl Spencer:—

> "But I am of opinion that we should never stand still, but rather be always aiming at new objects; and I sincerely think that that for which I am now striving is not absolutely Utopian. There is plenty of room for the introduction of another breed of animals without trenching upon or superseding in any way those which are valuable and now in existence. My object then may be familiarly stated to be the placing *merino wool* upon a *Leicester carcase*, perhaps not exactly resembling the short finest clothing wool of Saxony, but a fine combing wool superior to any that has heretofore been grown."

In continuation, he further justly adds—

> "I look upon what is commonly called a Southdown to be now a very different animal from the little pure Southdown of fifty years ago."

I shall only make a few brief remarks respecting the Ryelands, the Wicklow, Kerry, &c., sheep, as these are the only true short-woolled sheep which we have at present left within the British islands: of the first kind there are not probably to be found two pure flocks in existence, but were at one period much valued for their fleece, and also for the practice of cotting. They were hardy, and could endure hardship and hunger equal to any breed, but were of small size; their shape was very much like the merino, and a tradition exists that the merinos are descended from the Ryelands. The Kerry and Wicklow sheep partake of the fleece and form of the Ryeland, with the prolificness of the Dorset sheep, which they in other respects somewhat resemble, particularly in the circumstance of their receiving the ram at an earlier period of the season, by which means what is termed housefed lamb is procured at Christmas and during the first months of the new year; in Kerry, lamb is quite common at the latter end of March, and the Cork market is tolerably well supplied with house-lamb from this species during the month of January. Dublin is similarly supplied by the Wicklow sheep; London receives its early lamb from the Dorset; the latter are larger animals than the Wicklow or Kerry. Feeding house-lamb forms only a very minor portion of agricultural economics: we have merely alluded to the subject for the purpose of indicating the breeds best adapted for the purpose of such persons as may feel disposed to practise this part of rural economy.

Setting aside for the present the consideration of the Cheviots, black-faced, and other varieties of mountain sheep, we will proceed to examine the various qualities, as adapted to different situations, of the long-woolled races of sheep—these consist of the old Lincolnshire, Teeswater, Romney Marsh, Bampton, and Cotswold sheep. The thorough old Lincoln and Teeswater are all but extinct; they were ungainly in every way, were long arriving at maturity, arrived at very great weight, and possessed heavy fleeces: both these descriptions of sheep are now much mixed with Leicester blood, the cross doing better than the pure breed of either race, as, although the Leicesters when first put on the rich Lincolnshire marshes do better than any other sheep, it has been observed that after the third or fourth generation, successively bred on the same rich lands, the wool sensibly deteriorates in quality, known on the banks of the Tees by the term cotting; the frame also assumes an awkward appearance, and the disposition for early fattening in some measure disappears. The Romney Marsh were originally somewhat similar in character to those just described; in consequence, however, of the more heavy stocking of the Kentish marshes, together with the fact of the herbage on Romney Marsh not containing so heavy a per centage of the most succulent and feeding grasses, the Romney Marsh sheep did not attain the same weight of carcase or wool that the old Lincoln or Teeswater did, but, like the last named, did not arrive at maturity until they were three years old. The meat and wool were, however, of a finer quality than the Lincoln and Teeswater. The modern Romney Marsh sheep is a very superior animal, containing a cross of about one-third new Leicester blood; the wethers now arrive at market at two years old, instead of three as heretofore: the fleece and flesh continue good, and the cross has become gradually acclimated to the bleak winds of the exposed marshes. The upland Kentish sheep contain a still greater amount of the blood of the new Leicester and improved Southdowns, and is the only county with which we are acquainted where the mixture of the two latter with the original large breed of the country has effected a permanent improvement; this is probably owing to the fact that the uplands of a large portion of Kent possess a milder climate than such sheep walks of similar altitude in other parts of the kingdom; also to the circumstance that the chalks of Kent are much intermixed with a soil composed of debris from the gualt, green sand, and wealdean clay; in consequence of which the downs of Kent possess a much richer herbage than others composed principally of sand or chalk. In conclusion, it may, however, be observed that the pure Southdown or new Leicester will not answer on Romney Marsh; the former will not return an adequate amount of wool and flesh, and the latter would starve in winter.

Of the Bampton sheep I know little, and believe they are principally confined to the vicinity of Taunton and the more fertile vales of Devon and Somerset. The present breed is a cross from the old breed with the Leicester, and from the few specimens which I have seen in Smithfield market, I should judge from their appearance that their qualities are very similar to those of the improved Kent just described. The breeders of this class of sheep assert that it is the most profitable for wool and mutton of any breed in the kingdom; how much of their famed quality in this respect is due to the richness of the vales and the mildness of the climate in which they are reared and fattened we cannot say: that they are admirably adapted for the country in which they are adopted we are not prepared to dispute, but were their qualities to be tested on the Cheviot Hills with the native breed of that district, or on Romney Marsh during winter, we anticipate they would not come off altogether victorious. On this point it may be stated as a general rule, that whilst animals or crosses from animals bred on inferior pastures or severe climates may safely and often advantageously be removed to milder climates and better pastures, the reverse of this is often most disadvantageous, and should not be attempted without great circumspection and previously well weighing and balancing the beneficial or injurious effects that may arise therefrom; under such circumstances the cross should only be proceeded in with great care, and as it were experimentally, until the benefit was clearly seen and established by indubitable proof.

I now proceed to the consideration of the Cotswold, or, as they are more generally and emphatically known in places distant from the Cotswold Hills, the long-woolled sheep. The name of the hills has undoubtedly been derived from the practice pursued there centuries ago of cotting the flocks on the Gloucester Wolds known by that designation, and at one period was very generally practised in the counties of Hereford, Worcester, and Gloucester. Camden states that these cots were long ranges of buildings, three or four stories high, with low ceilings, and with a slope at one end of each floor, reaching to the next, by which the sheep were enabled to reach the topmost one; from this and other circumstances, there are good grounds for believing that the original breed of the Cotswold Hills were similar to the Ryeland and Morfe Common sheep of Shropshire. The fineness of the Ryeland fleece and freedom from kemps is probably attributable to the shelter and warmth they thus received during the inclemency of winter nights: whether this opinion is correct or not, there cannot be a doubt that the system of cotting has the effect of causing the staple of the wool to be much finer than it otherwise would have been.

The Cotswold is a large breed of sheep, and is the stock from which the class called new Oxford is sprung: they are superior to the new Leicester in hardiness of constitution, are more prolific, will sustain themselves "*by holding their own*," or improving on pastures and in severity of weather where the new Leicester would decidedly deteriorate. In suckling their lambs the Cotswold ewes are decidedly superior to those of the new Leicester; in this quality and in being more prolific the Cotswold agrees with those breeds which have been least indebted to the care of man. Although I have previously said that the Cotswold Hills were formerly occupied by a short-woolled breed of sheep, I by no means infer that the race known as Cotswold is descended from the diminutive Ryeland; I believe the Cotswold to be the original and finest type of all our long-woolled breeds; the old Leicester was a much coarser animal than the Cotswold, which I attribute in a great measure to the richness of pasture in that celebrated pastoral county. The fine upstanding sheep found in the wide-spreading and fertile vale of York, and known as Yorkshire sheep; the celebrated sheep on the Currah of Kildare, and the rich dry loamy soils of Kilkenny, approximate closely in character to the Cotswold sheep, the principal difference being that the former are not quite so large in the carcase, and the fleece not being quite so heavy, but possessing a much finer staple, the coarser wool of the Cotswold sheep being very probably attributable to the coarser herbage on the wet "*spewy*" pastures of the Cotswold Hills, for which description of places the Cotswold is the best adapted as compared with all other breeds of large sheep: it is only upon hills not exceeding 900 feet in perpendicular height above the level of the sea that the Cotswold sheep will flourish; and it must also be remembered that although they are cold and wet, yet they are covered with a soil otherwise tolerably rich, and yielding a considerable quantity of rough coarse herbage, greatly superior to that found on the Grampians, Cheviots, and hills of Cumberland, Westmoreland, &c., on which the Cotswold sheep would starve. Crosses of the Cotswold with the Leicester have answered exceedingly well in some places, and many of the carefully bred Cotswolds are scarcely to be excelled by any breed in England: for wet coarse pasture no large sheep is so well adapted as the Cotswold.

I have now taken a somewhat extensive review of the most widely diffused breeds of sheep which occupy all our level grounds and downs; we are therefore now about to enter on a review of sheep adapted to our more elevated and less fertile mountains. How the Cheviot came to be classed amongst short-woolled sheep by Sir John Sinclair and others is to me inexplicable, except from the circumstance that people were content to use a coarser cloth formerly than at the present day: that the staple of the wool has been lengthened, and the wool otherwise become coarser, I am prepared to admit, but certainly not to the extent that the fleece has been changed from a short felting wool to a combing quality. The Cheviot, when carefully bred, is a handsome compact sheep, not quite so "*leggy*" as the Cotswold and Yorkshire sheep, notwithstanding which they are an active race, are famous foragers, and withstand the vicissitudes of the weather exceedingly well, more so than any of the breeds previously noticed. They are particularly adapted to that class of hills from which they derive their name, and also to an extensive range of mountains which are to be found more or less extended over the whole of the Lowlands of Scotland. These hills principally consist of the upper silurian rocks (a large part of them argillaceous), limestone, and Plutonic rocks, the decomposition of which has produced a soil of tolerably fertile quality, but only thinly spread over the subjacent rocks and boulders, and much intermixed with stones; a great quantity of heathy bogs and moory soil are also to be found on these hills. Arable cultivation, on many accounts, is wholly out of the question; on places such as described, elevated from 800 to 1500 feet above the level of the sea, no sheep will pay the farmer equal to the native Cheviot. The present breed is largely crossed with the new Leicester, and is found an exceedingly profitable cross for the purpose of putting on turnips when hoggets. On a large part of the lower Grampians the Cheviots might advantageously replace, and in some instances are superseding, the black-faced breed, which we are about to notice.

The black-faced sheep are of the horned kind; they are a straight, upright sheep, with a short body, and from that circumstance are locally known on the borders as *the short* breed of sheep in contradistinction from *the long* or Cheviot sheep. They will clip on an average five pounds of wool, suitable for making a medium description of worsted, and would clip considerably more only from the circumstance that they are not shorn until late in the season, and then by no means close, otherwise if an unfavourable winter set in early the sheep would suffer most materially. Of the breeds generally known and extensively used, none have been found so well qualified to withstand the inclemency and hard fare of our highest mountains, with the exception of another breed, the Herdwicks, which are not generally known, but which will shortly be noticed.

The black-faced sheep are extensively bred on the Cumberland, Westmoreland, and Lancashire mountains, better known as "the Lake District," and more or less on the Lowland Scottish hills, and, with the hardy race of black cattle, are the sole occupants of the northern highlands of Scotland. That this breed can be greatly improved was evidenced by the fine animals shown at our Society's Newcastle Exhibition. They are exceedingly hardy. This breed has been very much improved in many places, but the improvements are made entirely by selection. All the crosses with heath sheep, having in view the improvement of the progeny as heath sheep only, have proved decided failures; but crossing with the Leicesters and Southdowns for the purpose of procuring lambs of superior quality, or with the intention of selling the produce of such cross as hoggets to the Lowland farmers, is a practice that has proved decidedly successful, and is practised in some places to the utmost extent that heath farms are capable of sustaining. To follow this system it is necessary that the farmer should possess some dale land, in addition to his heathy pastures; they will not fatten until they have quite turned three years old, and will then attain a weight of about 15 or 16 lbs. a quarter; we have seen some extraordinary fine ones attain a weight of 20 lbs. per quarter. It is worthy of remark at the same time, that these have generally been black-woolled sheep. The ewes are not put to the ram until about November, at which time they are brought from the mountains into the vales and enclosed lands in the vicinity of the homestead, for the purpose of salving or smearing, an operation to be noticed hereafter. A large number are also retained there until the commencement of the succeeding spring; to such, in severe weather, a little hay is given in addition to their ordinary pasture. The practice of drawing turnips, and distributing them to these sheep on their winter pastures, is also much increasing; the introduction of turnips amongst the dale lands of the mountainous districts has enabled farmers to maintain 50 per cent. more stock during the winter months than they were formerly capable of doing; the ewes are excellent mothers, with an abundance of milk; the lambs are weaned about three months after being dropped. These sheep are again collected in the vales about the latter end of June or beginning of July, for the purpose of being shorn, prior to which they receive a thorough washing in some adjacent stream. It has been doubted by some whether the black-faced sheep, which now graze the greater portion of the wildest mountains of England and Scotland, are those which have immemorially inhabited those districts; for Cully, on 'Live Stock,' observes that the dun-faced sheep were the early inhabitants of these mountain ranges; which sheep he describes as being sometimes to be seen, and as—

> "having faces of a dun or tawny colour; the wool is fine and mixed and streaked with different colours." "They are polled, small in size, weighing at four or five years old not more than 7 or 8 lbs. a quarter, the flesh being of excellent flavour. They are hardy and require little trouble; but in every essential quality, except the fineness of the wool, they were far inferior to the black-faced."

Dr. Anderson also shows that a breed of sheep that produced a finer description of wool than the black-faced sheep now yield was once common in districts of Scotland where the black-faced sheep only are now to be found. It prevailed in Annandale, Nithsdale, and Galloway; it lingered longest in some of the mountainous parts of Aberdeen. It was known not fifty years ago in Fifeshire. Hector Boethius, who wrote about the year 1460, takes notice of the fineness of the wool produced in various parts of Scotland. Speaking of the sheep in the vale of Esk, and where of late, until the introduction of the Cheviots the rough-woolled black-faced sheep alone were found, he says, according to Hollinshed, "Whose sheep have such white, fine, and excellent wool, as the like of it is hardly to be found again in the whole island." Sebastian Munster, in his 'Cosmographia Universalis,' published ninety years afterwards, says, in each country (speaking of the borders of England and Scotland) is such that nowhere is there better or finer wool.

Having made these incidental remarks, I shall proceed to the consideration of a breed which is very little known, the name not having extended much farther than the narrow precincts within which they are to be found. The breed alluded to is denominated the Herdwick, which is a polled breed, whilst the black-faced are horned. Its origin is involved in some obscurity; the traditional history is as follows: Early in the last century a ship was stranded on the coast of Cumberland, which had on board some sheep, stated to have come from Scotland. They were got on shore, and, being driven up the country, were purchased by some farmers living at Wasdale Head. They were small, active, polled, and their faces and legs speckled.* They were at once turned upon the neighbouring hills; they had not been there long before they evinced a peculiar sagacity in foreseeing the approach of a snow-storm, as it was invariably seen that a little before its coming, they *clustered together on the most exposed side of the mountain, where the violence of the wind usually prevented the snow from lodging.* This instinct caused them to be regarded with a degree of interest amounting to superstition; and their excellent qualities and adaptation to their new situation became speedily evident; some portions of the fleece were considerably finer than that of the common black-faced sheep, whilst the matted quality of the wool enabled them to endure any severity of weather. The proprietors of these animals determined to keep them as much as possible to themselves, and an association was formed,—one of the regulations of which was that no member should sell a ram and not more than five ewe lambs in one season. This monopoly, however, was soon evaded, and the breed has gradually spread; but it is still confined within very narrow limits, relatively to its adaptation to such extensive breadths of mountains. They are principally to be found on Langdale Pikes, Wasdale, Eskdale, Ulpha, part of Coniston, and Seathwaite, or, in other words, in that part of the lake district stretching from Ambleside, at the head of Windermere Lake, to near Whitehaven, in Cumberland; its northern boundary being Keswick Lake, and its southern Coniston Lake. The breed is, however, spreading fast into Westmoreland, viz., at Troutbeck, Sleddle, Grayrigg, &c.; they will doubtless ultimately displace the old heath or black-faced sheep. Great endeavours are now being made by the farmers in the district named to procure flocks of pure Herdwicks: some of whom have been constantly aiming at this point for upwards of twenty years, and are still under the impression that they have not got their flock to the

---

* From observations made in North and South Wales, subsequent to this paper being written, the writer is strongly inclined to believe that the Herdwicks are a Welsh variety of sheep, and also thinks that the Welsh mountain sheep might be greatly improved by situation and attention.

proper degree of purity of blood; it is certainly an indirect proof of the great value of this breed for its own peculiar locality, that farmers should strain and devote themselves to a point so apparently simple; but there are difficulties to surmount of no ordinary nature in order to procure a genuine flock, which serves in a like manner to indicate their great worth. These sheep, not being at first properly appreciated, got more or less crossed with the prevailing black breed, and to restore the breed to its original purity is one of the difficulties that a Herdwick flockmaster has to overcome. This difficulty is greatly enhanced by the peculiar habits of the animal, who is exceedingly shy, and cannot be held within any bounds in an enclosed country, except it is kept very quiet for a week. Another cause is that they are always depastured on the open mountain, where black-faced flocks also frequently pasture; this is a common source of disappointment to the breeder; in addition to which it must be remembered that if a Herdwick ewe gets with a black-faced ram, the sheepowner is often compelled to retain the progeny; for if he sells it, he cannot obtain a Herdwick in its place, in consequence of the scarcity and growing demand for the breed, not only to breed from for the perpetuation of the pure race, but also for the value of the ewes in rearing lambs crossed from Leicesters and Southdowns. When we see a set of careful farmers, than whom there is not a more thrifty and hard-working body in the United Kingdom, thus strenuously and perseveringly bending themselves to the one object—the improvement of the breed under consideration—we may rest assured that their superiority over the old black-faced race is of no ordinary description. As a proof of the value set on this breed, I insert the following account of the exhibition for the year 1848, which is annually held at Ennerdale Bridge. It will be satisfactory to agriculturist to know that the spirit of enterprise and improvement is to be found in this wild and remote district, and will serve as an example to others more favoured but less enterprising to follow in the like steps.

West Cumberland Fell Dales Association Sheep Show.—The annual exhibition of the Fell Dales Association for the improvement of the Herdwick breed of sheep, took place at Ennerdale Bridge on Friday last. The day was exceedingly fine—a circumstance which tended very materially to increase the numerical importance of the meeting, for which most excellent arrangements had been made by the Committee of Management and Mr. Robert Beck, who proved himself as good a caterer in that as in the culinary department. The full attendance of breeders and agriculturists generally, caused the trade in tups to rule with unusual activity, and it is computed that not less than two hundred specimens of the genuine breed changed hands on the occasion. Great impartiality and discernment were shown by the judges (Mr. Henry Steel, of Catta, Mr. Thomas Gasgarth, and Mr. Joseph Porter), who complimented the competitors on the excellence of the stock exhibited, and the visible improvement which had annually been effected in the different breeds since the show was instituted four years since.

The following are the awards made by the judges:—

Herdwick Sheep bred and depastured in the Ward of Allerdale-above-Derwent.

For the best Herdwick Tup of any age:—

		£.	s.	d.
Robert Briggs, Wasdale Head,	best	2	0	0
Robert Briggs, ditto	2nd best	1	10	0
Edward Nelson, Loweswater	3rd best	1	0	0

Eleven competitors.

For the best Herdwick Tup, not showing more than four broad Teeth:—

Robert Briggs, Wasdale Head	best	1	10	0
Charles Rawson, Nether Wasdale	2nd best	1	0	0
John Bowman, Mire Side, Ennerdale,	3rd best	0	10	0

Seven competitors.

For the best pen of five Herdwick Ewes, of any age, Lamb-sucked:—

Joseph Tyson, Tows, Eskdale	best	1	15	0
Thomas Pearson, How Hall, Ennerdale,	2nd best	1	5	0
Joseph Wright, Roughton	3rd best	0	15	0

Twelve competitors.

For the best pen of five Herdwick Ewes, not showing more than four broad teeth:—

Joseph Tyson, Tows, Eskdale	best	1	0	0
Charles Rawson, Nether Wasdale	2nd best	0	15	0
Joseph Wright, Roughton	3rd best	0	10	0

Seven competitors.

For the best pen of five shearling Gimmers, of the Herdwick Breed:—

Robert Briggs, Wasdale Head	best	1	0	0
Charles Rawson, Nether Wasdale	2nd best	0	15	0
John Tyson, Gillerthwaite	3rd best	0	10	0

Ten competitors.

For the best Shearling Tup, of the Herdwick Breed:—

William Ritson, Wasdale Head	best	0	15	0
John Tyson, Gillerthwaite	2nd best	0	10	0
Charles Rawson, Nether Wasdale	3rd best	0	7	6

Eight competitors.

For the best pen of five fat Herdwick Wethers.

No competitors.

Herdwick Sheep bred and depastured in the Ward of Allerdale-below-Derwent, and the other Wards.

For the best Herdwick Tup, of any age:—

Allan Pearson, Lorton	best	1	10	0
J. Sanderson, Beck Stones, Thornthwaite	2nd best	1	0	0

Five competitors.

For the best pen of five Herdwick Ewes, Lamb-sucked:—

Thomas Richardson, Threlkeld	best	1	10	0
Thomas Richardson, ditto	2nd best	1	0	0

Five competitors.

Premiums offered by the Keswick Manufacturers for the best white-fleeced Sheep of the genuine Herdwick Breed, bred and depastured in the Ward of Allerdale-above-Derwent.

For the best white-fleeced Tup:—

John Bowman, Mire Side, Ennerdale	best	1	0	0
John Tyson, Gillerthwaite	2nd best	0	12	0
Robert Briggs, Wasdale Head	3rd best	0	8	0

Twenty-three competitors.

For the best pen of five white-fleeced Ewes:—

Thomas Pearson, How Hall	best	1	0	0
Edward Nelson, Loweswater	2nd best	0	12	0
John Jackson, Swinside End	3rd best	0	8	0

Three competitors.

Being ninety-four competitors for prizes exclusively devoted to one description of sheep, all of whom dwell within, and have their flocks within a very limited extent of country.

The Herdwicks of the present day are characterized by being polled, and have brownish or speckled black and white or mottled faces; some few have black faces, and also some have horns, but neither of these are considered genuine; they are also known from the circumstance that, as they get older, they assume a white or grey appearance about the nose and legs (in the shepherds' phrase they grow raggy).* The ewes should always be polled; on a few wethers and rams small smooth horns make their appearance—a proof of intermixture of blood: the wool is fine, only about the neck and fore-quarters often intermixed with kemps. The wool on the body is open and very kempy, assuming in some instances the appearance of hair, and is only used for the coarsest purposes, such as horse-rugs, &c., and consequently obtains only a low price, notwithstanding which Herdwick flock-proprietors prefer this sort of fleece to one of better quality, as it is found from experience that stock with coats as described withstand the severe winter weather on the bleak mountains which they inhabit much better than sheep with a better fleece. A singular anatomical character is also found amongst many of them, viz. that of *having a rib more than any other breed, fourteen instead of thirteen.* If "they keep their ground well," as it is locally termed, the ewes are kept as long as they will breed, which is often until they are ten or fifteen years of age, and some few have been known to attain the age of twenty years. The wethers go off at four and a half to five and a half years old, and are generally killed without being placed on any better pasture, being found sufficiently fat off the mountain: in fact, they have been tried on turnips, clover, and other artificial food, without any commensurate advantage, and sometimes with an evident loss of crop and deterioration in the weight of the sheep. When fat, they weigh from 10 lbs. to 12 lbs.

---

* Or rimy; that is, have an appearance something similar to hoar frost. The true sort always assume this "rimy" aspect.

per quarter, and are the finest mutton produced in England, assimilating in flavour closely to venison; they also, when at the fattest, possess a larger portion of lean meat than any other sheep; and, when the legs are cured in the same way that pigs' hams are, make a most exquisitely-flavoured grill. The ewes are frequently sold to graziers in the vales, and are put to Leicester and Southdown rams; and, if put on good fair land, will fatten a lamb as large as themselves, being excellent mothers and possessing an abundant flow of milk. No hay is given to Herdwicks during the winter; they support themselves in the deepest snow by scratching down to the herbage, and if any part is blown bare they are certain to discover it. The lambs are dropped about the 12th of May, and are well covered with wool when dropped; sometimes the lambs are taken to the lower grounds the first winter. The ewes are not put to the ram until they are two years and a half or three years and a half old. There is another breed of sheep which are taken to the mountains in the north of England in April and May, and are brought to the lower grounds in November to winter. These are sometimes but improperly called Herdwicks; they are a mixed breed, being crossed with the heath or black-faced sheep, and the white-faced sheep of the low country, called "mugs:"* they are larger, and have more wool than the Herdwicks, and have not the propensity of fattening on the hills, equal to the latter. There is a striking peculiarity in connexion with the Herdwick sheep, viz. that when once domesticated, as it may be termed, to any particular portion of mountain land, the shepherd is always certain to find them on their proper locality, unlike the black-faced sheep, who are desperate wanderers. This valuable quality in mountain sheep has, however, this disadvantage, that the ewes, if removed from the place where they were reared, will be invariably found to return to their native locality at the lambing season. This renders it almost impossible to procure a flock of Herdwicks except by purchasing lambs, at which early stage of their growth this fixed attachment to the place of their birth may be presumed to be not so strong.†

The sheep of North and South Wales need not be mentioned, as they are every way inferior to the black-faced heath sheep, and greatly so to the Herdwicks; neither is the flavour of the mutton, size of the carcase, nor value of fleece, equal to the latter.

---

* This diversified cross is often termed mugs also. The term "mug" amongst the mountains alluded to is very generally, but ignorantly and improperly, applied to all large, white-faced sheep.

† This remark applies with full force as to the Principality, notwithstanding the preceding note in which the writer expresses his belief that the Herdwicks were originally derived from a Welsh stock.

It will be here proper to make some observations on a matter connected with sheep farming, which is only practised in the north of England and Scotland, viz. smearing, which is the name given for rubbing on the skin of sheep an ointment formed of tar and reasty butter, oil, or the foots of oil. The tar that should be used for this purpose comes from America, and is called "roany," being of a fat unctuous nature of the consistence of very thick molasses; although, for naval and general purposes, Baltic tar obtains a very superior price to this description of American tar, we have known instances where American roany tar has obtained double the price of the Baltic species when required for sheep-smearing. The usual proportions are 8 lbs. of tar of the kind described and 6 lbs. of butter, well mixed together and formed into a fluid ointment; which being prepared, the smearer commences operations by dividing and opening the fleece of a sheep along the back, laying the skin bare—when bared, he dips his forefinger in a pot containing the ointment, and by drawing it along the skin of the animal from the head to the tail, a portion of the mixture becomes attached to the skin; this being finished, he proceeds to open the fleece in the same manner on the part next the place first operated on; and so on until the whole of one side of the sheep is finished, when he commences on the other side: the cost averages from 4½*d.* to 6*d.* per sheep. The practice has been much decried, amongst others by "the Ettrick Shepherd," who states that, if the sheep are kept supplied with a sufficiency of food, smearing is unnecessary. That an abundance of food will in some degree counteract the ill effects of severe cold is perfectly correct, but I know that the neglecting to smear sheep in mountainous districts has been attended with the worst results to both animals and fleece.

The ill effect of smearing is that it stains the wool, but not so much as is generally imagined, if the operation is carefully performed in the manner previously described and properly compounded.

Mild weather, about the latter end of October and the beginning of November, should be chosen for smearing, as the sheep suffer very much if cold weather sets in before the wool has risen from the skin. When the wool has risen from the skin after smearing the animal does not suffer—a fortnight generally elapses prior to this taking place.

Having now reviewed at some length the different characteristics of the principal breeds of sheep, I will proceed to recapitulate briefly their adaptation to various situations as regards climate, soil, and food. It would be ridiculous to suppose that one of the large Lincoln, improved Cotswold, or, as they are now frequently termed, Oxford sheep, could compete with Down sheep on the bare pastures and hard stocked down lands. The natural habitat of the first is on rich moist pastures, or at least such pastures where, from the prevalence of moisture, a great weight of herbage is thrown up, though perhaps of a coarse nature, the result of which is that, a number of successive generations being thus abundantly supplied with food, without having occasion to use any considerable amount of exercise, the lungs decrease in size; exercise, in consequence, is fatiguing to the animal, which, as soon as its immediate wants are supplied, immediately lies down and begins to ruminate. In this way, after the frame has been fully developed, the greater portion of the food ingested is formed into fat and muscle; the quantity consumed in supporting the requisite animal temperature being decreased to an almost minimum amount in consequence of the little exercise used: in this way has the large Lincoln and Teeswater breed been formed. It will easily be seen that if Southdowns* were placed on the rich Lincolnshire marsh lands, their naturally active disposition would lead them to expend a considerable amount of force and consequently of food in exercise. Under such circumstances the down sheep would suffer in comparison with the larger animal. Under a reversed experiment, namely, take a large sheep to down land, the former would be starved on the short bite and dry herbage with which he would have to subsist, as compared with his former more succulent marsh pasture; independently of which it would have to travel over a greater extent of ground for its food, which, to a heavy animal requiring so much larger an amount of food than the native down sheep, would not only retard its feeding properties, but most probably would entirely put an end to them; or perhaps a diminution of flesh would take place. Now the native unimproved Cotswold, and sheep of an analogous description, such as the Yorkshire, Kildare, Kilkenny, and similar Irish sheep, a large sheep with white faces, called mugs in the north of England, are all of a hardier nature than the first described, doing well on rough, cold pastures, are longer legged in proportion to the weight of carcase than the former; are more active, as they have to seek their food over a greater extent of country, where the herbage is of a less nutritious nature, and consequently are furnished with a greater development of lungs, a circumstance intimately connected with the feeding qualities of animals, as I shall proceed to show when I take into consideration the discussion of the physiological and anatomical part of the subject. Another matter of some importance in reference to the varied adaptation of different breeds of sheep to different localities, irre-

---

* By Southdown is here understood not prize animals, but such as actually obtain their subsistence on the downs without any particularly extra amount of care.

spectively of the questions of climate, soil, &c., is the different character of the grasses composing the pastures of varied localities. For instance the down sheep are exceedingly fond of that grass which is found so abundantly on their native habitats, viz., the *Cynosurus cristatus* or crested dog's tail grass, yet will not touch the *Festuca Cambrica* or Welsh fescue; the Welsh sheep are equally fastidious, and would not touch the dog's tail grass so long as they can get the Welsh fescue. A very happy illustration of this difference of taste is given in Marshall's 'Survey of Norfolk,' where a flock of Lincolns and Downs were turned into the same pasture, which consisted partly of dry upland, partly of a marshy bottom, throwing up a great quantity of rank grass. The two flocks separated, the Lincolns being always found on the marshy part, the Downs as invariably on the dry part of the pasture. In making experiments on the relative value of sheep, it will always be necessary to keep in view that they are not too suddenly removed from one pasture to another of a totally different nature.

It will never be known in what manner the celebrated Bakewell proceeded in the first instance in order to obtain his celebrated stock. I agree in opinion with Marshall that he did not confine himself to any particular breed, but selected well proportioned animals which he considered would suit his views, from any breed: the Cotswold and old Leicester, doubtless, were those principally used; Down blood being little if at all employed. That there was a considerable amount of crossing, from sheep procured from various sources, is tolerably well evidenced by the fact that none of our celebrated breeds degenerate so soon from the true blood, after a second or third descent with foreign blood, as the descendants of the Leicesters on the third and fourth remove. They also vary greatly from the original type, even though kept to true Leicester blood, when removed to inferior localities as regards food and climate.

On looking at sheep of different breeds, it will be found almost invariably, that square, compact, and well-proportioned sheep have been grazed on good land, or otherwise well fed; whilst sheep bred and fed on indifferent pasture, will as constantly be found with deep but narrow chests. In very starved sheep, such as the Welsh, the fore legs will almost touch each other at the breast; at the same time the flanks will be pinched up like a greyhound's, thus greatly narrowing the compass of the intestines; such a form is emphatically entitled by farmers '*nip-gutted*,' and amongst domestic animals is the invariable indication of slow feeders, although when fat they are generally found to contain a more than average proportion of internal fat. The Irish greyhound pig, now nearly extinct, is a remarkable example of this profitless kind of animal. Amongst sheep we find this form amongst the Welsh mountain, the Herdwicks, and black-faced sheep. The Southdowns more or less partake of this form in the unimproved state. It must, however, be always kept in view, that though the above described sheep have not the quality of fattening early, they possess what is particularly desirable in order to fit them for their natural habitat, namely, great hardiness, powers of endurance and activity, which combination of properties enables them in their respective localities to obtain a subsistence and make a return to their proprietors where a finer kind of sheep would not only be unprofitable, but would most probably perish.

It is well known that all our improved breeds of animals are remarkable for their wide chests and deep flanks; the former appearance is usually considered an indication of large sized lungs; such, however, is not the fact. The attention of agriculturists was first drawn to this circumstance by Dr. Lyon Playfair, in the course of one of his admirable lectures, given during December, 1843, to the members of the Royal Agricultural Society of England, in which he remarks on this subject—

> "Now let us take two well-marked breeds and compare them. The Leicester breed of sheep have round, broad, and capacious chests; while the Southdowns have, comparatively speaking, narrow shoulders and breasts. But an inspection at the butcher's shop shows that the lungs of the Leicester breed are small, firm, and compact in their texture, while the lungs of the Southdowns are larger and coarser."

It was further stated that the habits of these breeds show this, as—

> "the Leicester sheep cannot inflate its lungs like the Southdown, and pants for want of breath."

It is also observed, that according to the aptitude of different animals to lay on fat is the relative size of their lungs, viz.—pig, sheep, ox, horse, &c. A further comparison may be made between the wild boar, with his high shoulders and narrow but deep chest, and the modern improved race of pigs, with their broad, capacious chest; also between the improved Leicester and the Herdwick, the Arabian and the Flanders cart-horse. The racehorse and the greyhound are probably the largest consumers of food as compared with other animals of the same races, and these are remarkable for their deep chests and large lungs, accompanied by the pinched-up flanks already noticed. From the preceding illustrations it may fairly be inferred that the broad-chested and square-formed animal is naturally adapted, from its weaker lungs, to a pasture sufficiently rich that it can obtain its food without much exercise: thus contributing in three ways to the desirable quality of fattening early from a small amount of food—in the first place, in consequence of possessing small lungs, the consumption of the carbonaceous portion of the food, such as starch, sugar, &c., is less than in an animal with larger lungs, the difference serving to furnish fat; secondly, the smallness of the lungs makes the animal indisposed to use much exercise, and thus becomes naturally addicted to those quiet habits which are so well known to aid materially in the well doing of fattening animals; and, thirdly, but indirectly, in consequence of the two first named qualities, such animals being found to be ill adapted to poor pastures, are placed only upon those of richer quality, where their profitable qualities become developed. The very fine prize animals which are exhibited of the Southdown breed would be almost equally unfit to graze the arid and bare pastures of the exposed downs as the Leicesters, and that just in proportion as their anatomical and physiological structure assimilated. It thus appears to be a rule which pretty generally holds good, that as a sheep gains in feeding properties, it loses in hardihood, and the reverse; notwithstanding which there are some cases which, although they do not amount to exceptions, yet are such variations that they give the farmer a considerable choice in selection: for instance, the Welsh, the black-faced, and the Herdwick sheep are of a nearly equal hardy nature, the last named being the hardiest, whilst at the same time it will return a greater value of wool than the first, nearly equal to the second, and in fat and flesh will yield a money return for its food greater than either, whilst heavy losses through hard weather rarely occur with the Herdwick.

On some pastures between the character of down and heathland, it may be desirable to possess an animal of considerable endurance, good size, with aptitude to fatten—for such we must look to the Cotswold and crosses thereon, together with the Cheviots. These breeds possess moderate activity, endurance, and fair fattening qualities, and will do well on pastures where a first-rate Leicester would scarcely obtain a living. The character of these pastures has already been described. The downs appear, for the reasons already given, as well as from long experience, to be best adapted for their own localities; should, however, arable cultivation take place on down land, it will then become a question which breed is best adapted under the altered circumstances—the Leicester, or the Southdown? In considering this question we entirely put out of view the value of folding, which was always a doubtful practice, and was only justified under peculiar circumstances; besides it is capable of proof in a great degree that what was gained in corn by this method was lost in meat and wool; it is the more questionable now, when the benefit that was formerly derived from folding can be obtained from using a few hundredweights of guano. For mountain sheep there are none comparable with the Herdwicks.

I cannot leave the subject without again adverting to a practice previously noticed in describing the Herdwicks, viz., putting first-class Leicester and Southdown rams to Herdwick ewes; the produce is a very superior animal for grazing purposes, and fattens quickly to a large size, combining hardihood and aptitude to fatten beyond any other breed or cross, particularly as hoggets.* If this kind of sheep should become generally distributed over our worst description of mountain land, I believe the mountain flock-owner would find it his most profitable business to rear the crosses alluded to as stores for the lowland farmers, and that the latter would find it more profitable to purchase such stock than to be rearing lambs. From these considerations, and also from observing that, unless carefully looked after, both the improved Southdown and Leicester gradually become changed for the worse in the course of two or three descents, I look upon it as an established fact in husbandry, that tup-breeding will become more and more a distinct occupation. In stating this I do not anticipate a continuance of very high prices for male animals; but I believe the practice of buying or hiring tups, instead of using a home-bred animal, will become more generally adopted, as flockmasters will find their profitable account in doing so, whilst the extended demand will remunerate tup-breeders for the lower prices accepted. In viewing the original habitats of the large and small breeds of sheep, it will be seen that the Teeswater, Lincoln, and Leicester were originally produced on rich lowland pastures, where the absorbent properties of the soil, whether it consists of marl, clay, or vegetable loam, except in very dry seasons, yields a plentiful supply of juicy herbage; consequently animals grazing such pastures would not be under the necessity of using much exertion in procuring sufficient food. The combined effects of using little exercise and passing a considerable part of their time in the act of rumination, would cause the air-cells of the lungs to be constantly surcharged with blood.† This deficiency of exercise would also predispose the animal to be still more inactive, by which means a large part of the carbonaceous matter of the food, which would other-

---

* The practice of putting Southdown rams to mountain sheep is now much followed amongst some farmers adjacent to the Choydiar Range of hills in Flintshire and Denbighshire, and is found a very profitable method of breeding good useful lambs; the practice is principally followed by the lowland farmers of this district, who purchase in autumn a flock of ewes from the mountain farmer, feed them on turnips, &c., during the winter, send the lambs to market in summer, and the ewes in the autumn following.

† Prize runners, in order "*to obtain wind*," as it is termed, undergo severe training, in running and walking exercise, in order to remove the partial state of repletion of the lungs, arising from the inactivity and overfeeding of ordinary life.

wise have been consumed in the lungs and exhaled in the form of carbonic acid, becomes deposited in the cellular tissue as a hydro-carbon—fat.

With the hardier active breeds of sheep, such as the Southdown, Ryeland, Black-faced, Herdwick, &c., the lungs are more largely developed in consequence of the additional exercise which they are compelled to take in order to obtain a sufficient amount of nutriment; on the dry downs being deficient in quantity, whilst on the heathy mountains it is deficient in quality—either or both causes will necessarily compel the sheep occupying such pastures to make increased exertions to satisfy their appetites, beyond what would have been required from them were they grazing on a luxuriant plain; thus a development of lung and corresponding activity of disposition become concomitant physiological features of the respective breeds. From this cause arises the fact that the old down and black-faced sheep will not fatten until they have passed the third year, for which the following reason may be assigned: in the earlier stages of life the circulation of the blood is much quicker than at a maturer period, being the most rapid in infancy, and the slowest in old age. This is one of the most beautiful provisions of nature, as by this means the warmth necessary during youth and infancy is secured; every extra pulsation which drives the venous blood through the lungs in order to become again oxygenated is attendant with the formation of carbonic acid gas, evolved in the act of respiring, heat at the same time being developed. As the animal becomes older, the circulation ceasing to have the same rapidity, consequently consumes less of the carbonaceous matter in the food, the difference being, as in the former instance, converted into fat: a large development of lung is therefore inseparably connected with a breed which is constantly exposed to the effects of cold, as on a bleak down, in order to maintain the requisite animal heat; this scantiness of herbage enforces on the animal increased exercise. Large lungs and great exertion are both adverse to the formation of fat. It is therefore clearly impossible to obtain a breed of sheep which will withstand the effects of cold and scanty herbage, and at the same time possess the valuable property of arriving at early maturity. All the breeds which are of a hardy nature possess deep, but not wide chests, such are the black-faced, the Herdwick, the old-horned Wiltshire, the old Southdown, the Welsh, &c., and all require to have passed their third year before they will put on fat profitably. The Cheviots and the Cotswolds hold an intermediate position between the Leicesters and the more hardy races, not possessing the early fattening property of the former, nor quite so hardy as the latter; in this respect it will be found that their position is fixed in a great degree by the character of the country they inhabit,* the Cheviots being found on rocky and lofty hills, covered with heath, but with a soil tolerably rich formed from the decay of trap and other decomposed Plutonic rocks, which with the moisture of the climate affords a not inconsiderable amount of nutritious herbage, often a much greater weight of herbage per acre than is found on the dry downs of the south of England; with the Cotswold, though on a different geological formation, the same general remark holds good. The Cotswold hills vary greatly in the character of their soils, having generally, however, much more moisture than down land; being composed of the following strata, viz., lower lias shales, lias marlstone, upper lias shales, inferior oolite, fuller's earth, stonesfield slate, and ragstone, and beds of clay. At several of the outcrops of the impervious argillaceous beds, numerous small land-springs are formed, which keep what would be the otherwise arid calcareous and arenaceous soils tolerably moist, and consequently yielding a considerable amount of rough herbage adapted to the breed of sheep found in the district. It must, however, be remembered that although the herbage is abundant it is not equally nutritious, and, consequently, imposes on the animal a considerable amount of exercise, which, by a natural reaction, causes an increased development of lung, which last property depreciates the early fat-forming propensity. We cannot, therefore, ever expect to obtain a breed of sheep which will possess the hardihood of the Herdwick with the early fattening property of the new Leicester, neither can we expect the fine felting property of the Saxon merino with the long staple of the new Leicester wool; all that we can do is to select each kind for the locality to which its physiological condition and general habits best adapt it: these will be the new Leicester for rich pastures, and also those of moderate fertility in moist climates: it is also the breed especially adapted for that part of arable husbandry which consists in consuming root crops, such as turnips, rape, &c., on the ground. The Southdown is particularly well suited to dry exposed downs—their natural dwelling place. They will also do well on good pastures, but will not make a proportional money return equal to the new Leicester, particularly since the change that has taken place in the wool market; if, however, down flockowners would only produce a wool such as has been already described, there can be little doubt but they would be made to rival if not to exceed the new Leicesters in the money return. A heavy fleece like the Leicester must not be

---

* On the lower Silurian Rocks of Denbighshire, known as Mudstones, the Cheviots are found to do well by Colonel Myddleton Biddulph of Chirk Castle, and H. R. Sandbach, Esq., of Hafodunos. We doubt, however, whether they would do well on the arenaceous greywacke soils of the Upper Berwins, and the slate clay alpine summits of Caernarvonshire.

looked forward to, as the arid nature of down pastures forbids such a result; a lengthened quality possessing fineness of staple, so as to obtain an enhanced price per lb., with no great additional weight of fleece, is what must be aimed at. For mountain sheep none equal the Herdwick, of which sufficient has already been said. On rough pastures exposed to cold and wet, yet not partaking of the nature of heath, the Cotswold will be found well adapted, as also on wet, cold, impervious clays; the Cheviots possess a somewhat similar character.

XXII.—*On the Management of Barley.* By HALL W. KEARY.

PRIZE ESSAY.

BARLEY, unlike the more valuable grain, wheat, can only be grown successfully upon certain soils, and under certain circumstances adapted to its culture; for while the latter may be sown with advantage upon almost every variety of land, and under apparently disadvantageous circumstances, the former, that is to say, the finest malting samples, cannot be produced in perfection without great care and management in the preparation of its seed-bed. The time of sowing and variety of seed are also important considerations; I propose therefore to treat this subject under the following three heads, those pointed out by the Society, viz.:—

1st. The preparation of the land.
2nd. Advantages and risks of early sowing.
3rd. Different varieties of seed as suited to various situations.

Upon the proper preparation of the land depends most materially the *quality*, even more perhaps than the quantity of the future crop; and although the finest samples of barley are only produced on soils generally known as decidedly barley lands, yet even on these the greatest difference is often seen in the same season, and with other circumstances alike, when different systems of tillage have been adopted; I shall now endeavour to describe the different modes of growing barley which have come under my observation in various districts of the kingdom. In several of the Midland counties there are fine deep loams upon gravel, and also upon clay, which produce very bold heavy barley, although it cannot be said to hold for malting purposes the first place in the London market. The usual system followed in those districts, upon what are termed turnip and barley soils, is to sow barley after turnips, which have previously been wholly or partially fed off by sheep. The firm and beaten state produced by the continual treading of the sheep is generally broken up during the autumn and winter months by the plough, and in this state the ground remains until the time of seed. Scarifying and harrowing is the only additional preparation given before the seed is sown or drilled; which latter plan is now very general, although there are some farmers in those districts who still contend for the broadcast system. Unquestionably the more the seed can be dispersed over the ground the better; but the difficulty of depositing it at an equal depth is the great objection; for hence two or three growths are the result, entirely spoiling the quality of the grain and involving much trouble and difficulty at the time of harvesting. The drill, on the other hand, sows exactly the same quantity throughout at an equal depth, and thus all grows together and is ready for the scythe the same day. The sowing season varies according to circumstances from the middle of March to the end of April. The chief varieties of seed are the old common barley, the Chevalier, and the Nottingham long-ear. Chevalier is now more generally grown than it was, although some contend that it does not produce so much per acre as other varieties; it is also more sought after by maltsters and commands the highest price. On some of the rather strong clay lands of the Midland counties it is not unusual to grow barley after fallow. The land being left rather rough and cloddy in the autumn, the seed is sown broadcast as early after February as the weather will permit upon the stale furrow, and dragged or scuffled in without any further preparation. Very good crops too of barley are frequently grown upon this plan; and for such soils I very much doubt whether a better one could be adopted. In some of the southern counties the turnip-land is ploughed up as soon as it is dry, and then well worked twice with the scarifier or drag-harrow, upon which the seed is drilled, at the rate of about 3 bushels per acre.

On all warm genial soils the sowing commences as early after February as possible; but on the colder lands it is thought preferable to leave it until April, unless indeed they are very rich, in which case the earlier the seed is sown the less will it be laid.

Generally speaking the common sort of barley is more usually grown in the south; the Nottingham long-ear is occasionally sown, and so is the Chevalier, but the latter is somewhat out of favour in some districts, as it is said not to produce sufficient quantity on those soils.

Hertfordshire is much celebrated for the quality of its barley, and I believe the London brewers consider the malt made in some parts of that county the best in the market. The finest samples are grown in the light districts, which have generally a chalk subsoil. The land is, for the most part, ploughed only once, and the seed sown in March or April. On the stronger lands, on which some years ago a fine malting sample could not be produced (when the old common barley was sown), very good crops of superior quality are now obtained, since the introduction of Chevalier, which has very much superseded the other varieties.

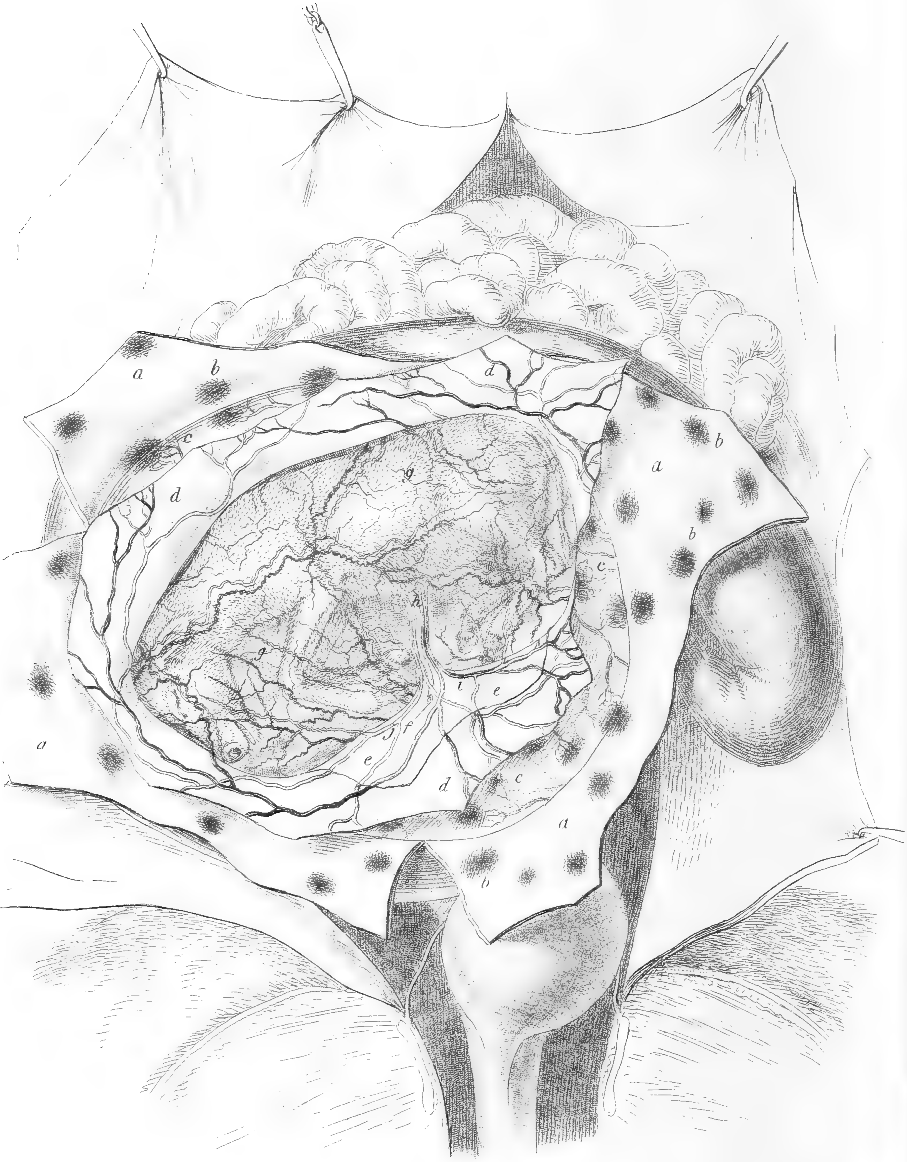
The Yorkshire and Lincolnshire wolds have of late years become large barley growing districts, and although their northern climate is somewhat unfavourable for producing in perfection that grain, which delights in warmth; still the system of high farming so extensively carried on in those counties has enabled them to rival, if not excel, some of their more favoured southern neighbours.

In those districts the white turnip is chiefly grown, and the whole or greater part of the produce is fed off with sheep; when Swedes are grown, they are seldom or ever stored, but are left standing where they grow, until they are wanted in spring. It is a prevailing opinion amongst the Wold farmers that they obtain a much better crop of barley after white turnips than after Swedes; whereas a completely contrary opinion exists in Norfolk, so celebrated as a barley growing county. It may not be amiss to compare the different systems, and endeavour if possible to arrive at a correct conclusion. As the feeding properties of the Swede are decidedly more nutritive than those of the white or common turnips, it is fair to presume that the manure from sheep fed upon the former will prove a richer fertilizer than that from sheep fed upon the latter. In Norfolk the Swede turnips are generally speaking stored in November and December, and the land is thus relieved from the exhausting effects of a root crop, drawing for so long a period nutriment from it. May not this circumstance explain in some degree why a difference of opinion exists in two districts alike celebrated for good farming and for intelligent agriculturists? After close observation of the difference in crops of barley after Swedes, as compared with barley after white turnips, I must decide in favour of the former; and I cannot but think that if more attention were given to this subject by those eminently practical men, the farmers of the Wolds of Yorkshire and Lincolnshire, and if the Norfolk plan were fairly tried and tested, opinions, which I am bound to think erroneous, would gradually give way. Then I believe we should see that most valuable of roots, the Swedish turnip, growing on the best wold lands, producing infinitely more sheep feed, and consequently more mutton, and, from the increased fertility imparted to the soil, producing more barley also; nor would the advantages end here, although it may perhaps be foreign to the subject to trace it further; but if the soil be fertilized for barley it will also tell upon the clover, and this again on the wheat crop.

The plough is mostly used in the Wold districts for breaking up the turnip land after feeding sheep. The land thus remains until seed-time approaches, when it is dragged and harrowed, and the seed occasionally drilled. In many instances the seed is sown broadcast, and then well dragged in with the scarifier. The objections to this plan, which I have previously alluded to, are, however, becoming apparent, and the drill is more frequently seen than formerly. From 10 to 12 pecks per acre are usually sown. The general seed-time varies, from the first week in March to the end of April.

The Norfolk system of storing Swede turnips has been already alluded to, and I will now endeavour to describe the different plans of growing barley generally adopted in that county. In addition to the growth of a large breadth of Swedes, the most spirited farmers consume a large quantity of linseed cake, crushed barley, or peas, with their feeding sheep; and it may here be right to notice one circumstance connected with this practice, which I think must be admitted to be true, viz., that although the produce per acre of the barley crop may be increased, it is yet thought that the quality is somewhat deteriorated, perhaps, however, not to such an extent, but that the increase in produce more than makes up for any deficiency in price. To this system, perhaps more than any other, is to be ascribed the fertility and corn producing capability of some of the worst lands of West Norfolk. I believe also it is universally allowed that the above is by far the best and cheapest mode of bringing a poor farm into a state of high cultivation. The cake passing through the animal, an increase of mutton is added to the increase of corn, and the cost of artificial manure is thus doubly paid for. It is usual to draw off a larger proportion of the root crop for consumption in the yards by oxen, from those fields where the fatting and cake-consuming sheep are intended to be fed.

The system of ploughing twice for barley very generally prevails in Norfolk. Experience has invariably shown that more barley can be grown from twice ploughing than from once. By the former system, the manure of the feeding sheep is more equally and intimately mixed with the soil than when it is merely turned over once; and, of course, the greater part of it left at the bottom of the furrow. As the last ploughing generally takes place immediately before sowing, a lighter, kinder, and more genial seed-bed is also obtained than when sowing takes place on the dead surface of land ploughed up many weeks previously. It is, however, frequently found that in all soils, except those of the lightest and most sandy character, the use of the plough in



FOETUS IN UTERO,

surrounded by its membranes

J. De C. Sowerby sc.

the first instance, for breaking up, is not altogether the best; the land is left too close and impervious to the action of frost, and frequently does not work so well in the spring as when some of the following modes are adopted. A strong scarifier, with the teeth closely set, and drawn by four horses, is frequently used to break up the turnip-land; in which state it remains, rough and uneven, until the proper time for the second ploughing arrives, which invariably is performed immediately before it is thought proper to sow barley. Another plan occasionally followed, is to remove the iron breast or mould-board, substituting a piece of rough wood in its place, or anything, in fact, to keep the furrow open, without turning it completely over, which thus presents a rough and accessible face to the action of frost, or other numerous atmospheric changes, which invariably mark our English winters. If this operation be well performed in dry weather, and a small and sufficiently deep furrow taken, I believe the land is left in the most favourable state for producing a good and genial seed-bed for the future crop. This surface is of course well harrowed before the second ploughing takes place, which, as before observed, is not done until immediately before barley sowing; upon the large light-land fields of West Norfolk it is usual to plough the whole field, and then drill across the furrows. If the drill follows the plough, it does so upon a less level and even surface, and the seed is not deposited so equally at one depth; nor can the drill-man perform his work so straight and well, from the impossibility of preventing the drill-coulters running into the furrows made by the ploughs. Harrows follow the drill, and, in some instances, the roll; and the small seed-machine, followed by light harrows, complete the operation.

Upon stronger land, and especially in a wet season, it is usual for the drill to follow the plough; so that all the work may be harrowed and finished close up at night. Upon these soils the rolling does not take place generally until the barley has made its appearance above the ground and become strong in the blade; when the passing of a light roll across it breaks the mouldering clods, and gives a little fresh soil and firmness to the roots.

It used to be a very common practice in Norfolk some years ago, to sow the barley broadcast, and then plough it in with a one-horse plough. In some parts of the county, on light tender land, this system still prevails, though it cannot be said to be at all generally practised.

On strong soils, which are apt to work unkindly in the spring, the plan of two-furrowing or ridging is frequently adopted. The ploughman takes rather a shallow furrow to start with, and returns with a deeper, leaving a small balk, and turning it over so as to leave a complete ridge; when this has been exposed to the atmospheric changes for some weeks, an opportunity of dry weather is taken to reverse these ridges and expose the inside to the weather. It thus remains till seed-time, when a skeleton plough is used to split open the ridges; it is then well harrowed, and levelled as much as possible. The drill follows immediately; and if the above operations are performed properly in dry weather, an admirable seed-bed will generally be the result.

There are, however, objections to the above mode which ought to be stated. It is most difficult to make the land completely level: and hence, particularly in a dry season, the furrows show themselves in the growing crop, which always looks much stronger and healthier in alternate rows all through the field. This is more seen in the early part of the season, but it cannot be doubted that it must operate unfavourably upon the yield when the time of cutting arrives.

The usual time of sowing may be said to extend from the middle of March to the end of April, although the two first weeks of the latter month are generally considered, in average seasons, the most favourable. Upon some of the stronger and more backward soils, barley is sometimes sown early in March, and, provided the land works well, undoubtedly the quality is improved by early sowing; but it is generally thought that the quantity is somewhat diminished. The old common barley is now but little sown in Norfolk. Within the last few years Chevalier has become very general. "The Brewers' Delight" is almost, if not quite, equal to Chevalier for malting purposes, grows stiffer in the straw, and is gradually coming into use. The Nottingham long-ear is a great favourite with some, while others prefer American barley. Another variety, obtained from Leghorn, has lately been introduced, and it is favourably spoken of by the maltsters, but experience has not yet tested its productive qualities. Chevalier, however, is still grown by many, and when care is observed to change the seed, by taking it from a different locality, I believe few kinds will be found to equal it.

Having now described the different systems pursued in some of the most important barley-growing districts, I shall, in conclusion, make a few observations, founded on experience and personal observation.

It has before been noticed how much depends upon the way in which the land is treated in the first instance, not only as to the mode of performing the work, but also as to the weather in which that work is performed. It is no uncommon occurrence to see ploughing going forward upon land intended for barley when the water stands in puddles on the surface, and the whole ground is perhaps saturated with moisture, the idea being to get the ploughing done in order to accelerate the spring work. The ploughing is then done, it is true, but it is not sufficiently considered that numerous harrowings, rollings, and perhaps clod-crushing, must be gone through before barley can be sown amongst clods, which are the sure result of working in wet weather. Nor is the labour and loss of time of those operations the only evil; soils forced into tillage by harrows and rolls, rarely, if ever, become kind and genial for the reception of the seed; and it must be strong in the recollection of all who have sown barley under the above circumstances, that an inferior crop has generally been the result. Upon very light sandy soils liberties may be taken in wet weather, with little or no bad effect, but upon land with any degree of staple in it, I am inclined to think that too much importance cannot be attached to working it at every stage in dry weather. There are, however, peculiar seasons when the weather is so constantly wet, that it is almost impossible to carry out the above practice strictly. As a modification of the bad effects of ploughing turnip land for barley, when the soil is too wet, I last year saw tried, and with remarkably beneficial effects, a most simple plan, which, although from its very simplicity some may be tempted to despise, I am convinced is most efficacious. A piece of cord was tied round the fore-part of the breast or mould-board of the plough, which prevented that smooth shiny surface left by it in wet weather, and entirely removed the necessity for rolling; whereas in the same field where the cords were taken from the ploughs, large clods prevailed, and the greatest possible difference was perceptible to the most casual observer. For those soils generally denominated turnip and barley soils, I think there can be little doubt that the system previously described, of breaking up in the first instance by a scarifier, or skeleton plough, and then ploughing immediately before sowing, is preferable to the more common mode which prevails in some districts, of merely ploughing once and then putting in the seed. In the first place the manure is thoroughly mixed and ready for the young roots of barley as soon as they begin to shoot, and in the generality of seasons, moreover, a better tilth will be obtained. For these lands, also, the drill system must, I think, be considered the best and safest. There may be districts, circumstances and seasons, which would point out another mode of sowing to be more advantageous; but these may be deemed exceptions to a practice, which, I cannot but think, will be still more universal. After drilling very much harrowing and rolling are by no means desirable: the land may with advantage be left somewhat cloddy, provided the clods are small, until it is time to sow the small seeds, when the light roll makes it sufficiently fine, and gives a little fresh soil in which to sow the young clover.

Advantages and risks of early sowing.—Although very early sowing is strongly advocated, I hold it to be quite impossible to fix any period which will suit all circumstances and seasons. If the weather be perfectly dry and the land works well in February, the quality of the barley will unquestionably be improved by early sowing; but that a corresponding increase takes place in quantity may, however, I think be doubted. There is a great difference in seasons, and a practice which would prove highly suitable to one year might, if persevered in under different circumstances and with different weather, be productive of very injurious results in the next. It can never be judicious to meddle with the land in the spring until it is dry and works well. On strong cold land also, barley should be sown much earlier, generally speaking, than upon light sandy lands with a warm dry subsoil. In the former there is no danger of a too rapid growth in the first stages, and the land having sufficient staple to carry it out, the quality of the grain will be decidedly improved and the period of cutting will be accelerated. On the other hand, if sown before the land is in proper tilth and fit to receive the seed, a rough coarse sample will be produced. The invariable result of very late sowing, there can be no doubt, is an inferior quality of corn. From the 20th of March to the same date in April will, I think, in average seasons be found a safe and judicious period for barley sowing.

There is at the present day a great difference of opinion as to the question of thick and thin sowing; after several careful experiments, I am inclined to favour a middle course. From 8 to 10 pecks per acre on kind and genial soils will generally suffice; but on unkind land in imperfect tilth it may occasionally be necessary to sow a larger quantity.

The different varieties of barley comprise the old common barley, Chevalier, Brewers' Delight, Oakley, American, Nottingham Long-ear, Berkshire, &c. The Chevalier decidedly ranks first for malting purposes, and is most eagerly sought after by the brewer in every district. The objections urged against it are, that it does not produce so much per acre as some of the other varieties. I am, however, inclined to think that, under proper cultivation and with occasional change of seed, there are few sorts that can be compared with it. I will give the result of some experiments carefully tried between 1836 and 1845:—

	CORN.		STRAW.		
In 1836	Bush.	pecks.	Tons	cwt.	lbs.
Chevalier	42	0	0	14	1
Common barley	42	0	0	15	6
American	40	0	0	14	4
1841					
Brewers' Delight	57	1	1	6	6
Berkshire	56	2	1	6	2
Chevalier	60	1	1	7	6
Nottingham	56	3	1	8	0
1845					
Brewers' Delight	52	0			
Chevalier	48	3			

The foregoing experiments are strong proofs in favour of Chevalier—in every year it was the best quality. "Brewers' Delight" is, I believe, quite equal to Chevalier for malting purposes; and in appearance, there is in fact little or no difference. I am a very strong advocate for a constant and judicious change of seed, and although it may sometimes be expensive to obtain it from a great distance, I believe it will generally repay the cost by an increase of produce and an improvement of quality.

A few years ago a very strong instance confirming my opinion in this respect came under my observation. On two adjoining farms, in a barley growing district, both much alike as to quality of soil, the occupier of No. 1 being in the habit of constantly changing his seed and sowing tolerably early, and the occupier of No. 2 systematically never changing his seed and sowing rather late, the quality of the barley grown upon No. 1 in the year referred to, was remarkably good; and upon No. 2 it was so very inferior, as to be quite unsaleable for any but the most common purposes; and 2*s.* per bushel, or 16*s.* per quarter, was the difference in the price these barleys fetched at several times during that season, on the same day and at the same market. The produce per acre also was, as nearly as could be ascertained, very much greater on farm No. 1.

I have never heard that Chevalier, or any of its varieties, were not hardy, or incapable of being produced in cold and bleak situations; but rather the contrary, and on the whole it appears that the charge brought against it, of yielding badly in some districts, is not borne out by universal opinion. Before it be condemned, I should strongly recommend all to test it accurately by careful experiments.

There may be, and probably are, descriptions of land quite incapable of producing the best quality of barley, and upon such soils, a greater produce of the common barley may perhaps be grown. It would, however, be going too far to recommend this or that variety as being the best or most productive for every locality; but my own opinion is decidedly in favour of Chevalier and Brewers' Delight; bearing always in mind the necessity for a change of seed, and care being taken to sow the boldest and best that can be obtained. There can, I think, be no doubt that the same laws prevail in the vegetable as in the animal world. Few will dispute the fact, that strong and healthy animals propagate a like progeny, and *vice versâ*. So we may fairly infer, and it is moreover borne out by the results of practice, that from the largest and best kernels of grain of every description the best crops will be produced.

XXIII.—*On the Theory and Practice of Water-Meadows.*

By Ph. Pusey, M.P.

Some years since a slight account of some Devonshire water-meadows, and of the cheap rate at which they are formed, was inserted by me in this Journal. Having now formed some myself on the same plan in Berkshire, I am thus enabled to state distinctly what they have cost me; and if the money so spent yield a profit of 30 per cent., which at a moderate estimate it can be shown to do, this mode of improvement must deserve the attention of landlords, now especially, when tenants stand so much in need of assistance, and labourers of employment.

It is well known that, in forming water-meadows, to moisten them is not the main object, the stream being laid on chiefly in winter, when commonly the ground is already rather too wet. Yet a slight film of water trickling then over the surface, for it must not stagnate, rouses the sleeping grass, tinges it with living green amidst snows or frost, and brings forth a luxuriant crop in early spring, just when it is most wanted, while the other meadows are still bare and brown. It is a cheerful sight to see the wild birds haunting these green spots among the hoar-frost at Christmas; or the lambs, with their mothers, folded on them in March. A water-meadow is the triumph of agricultural art, changing, as it does, the very seasons: but though our rustic forefathers so long since mastered the result, the mode of the water's action has been left a mystery. It consists not in moistening the roots, for they are moist enough—nor yet in covering the surface, for *stagnant* surface-water is merely injurious, the fluid must be kept in motion, however slow—it is not in the deposit of fine mud, for though the first runnings after the autumn rains are rendered the most beneficial by the thickness of the waters, a stream, clear as crystal, is often employed. About Exmoor I have seen a stream issuing near the top of a steep moor-side, down which, in its descent, it draws a straight line of vivid verdure, visible at a mile's distance against the black heath. Not but where a deposit does take place, it is most beneficial. However dull the stream when it enters, after trickling through the grass it issues clear. So that, as I have heard, at Tempsford, a sluggish mill-stream previously thick, allows you, after it has passed over the meadows, to detect the pike basking six feet deep under its surface. The matter thus left behind is proved to be fertilizing by the superior efficacy of the first floods; but where are we to seek the cause of the *clear* water's action? An experienced maker of water-meadows examining a spring, told me, after feeling the water by holding some of it in the palm of his hand, that it must be good for watering: all streams, it should be remembered, are not equally good, some are even injurious. When asked the ground of his opinion, he answered, that it felt warm and oily. To confine ourselves for the present to the former quality warmth—springs, issuing as they do from different depths, and partaking therefore more or less largely of the earth's central heat, vary much in their temperature, though most of them, perhaps all, are warmer than the earth's surface in winter. But the warmer the spring the better it is considered for water-meadows in Devonshire, where springs are much used for the purpose; elsewhere it is chiefly small rivers which are so employed. We must suppose, then, that the water acts in irrigation partly by the warmth it communicates to the soil. A curious proof of this view is afforded by the following circumstance:—There is a stream in Devonshire which was useless in irrigation until it reached a station of the Atmospheric Railway, where warm water escaping into it from the steam-engine, rendered it *at that point, for the first time, beneficial to the land it passed over.* In that county where the warmth of springs is much studied on this very account, a wide difference of temperature is found in springs issuing from the same hill-side. Some springs freeze at once in a hard frost, a thick basin of ice forming around the well-head. Another spring a few hundred yards off may be seen on a frosty morning steaming like a cauldron. It not only does not freeze at the source, but its waters will continue to pass in a fluid state over meadows during a frost. The warm spring is selected for irrigation: the cold one is kept aloof. It is also supposed that the south sides of hills yield warmer streams than the north sides, and these southern streams are therefore preferred for meadows. We may safely conclude then, I think, though I have never seen it so stated in any agricultural work,*

---

* Since the above was written I find that, though recent agricultural works deny the efficacy of warmth in irrigation, Sir H. Davy, himself a west-countryman, asserts it in his Agricultural Chemistry.

that the main principle of irrigation is the warmth produced by the water trickling over the surface. Warmth is a prime agent in vegetation, and a slight difference in warmth has a marked effect in hastening or retarding the growth of plants. On hills of a very moderate height—as the chalk range in Berkshire—the harvest is sometimes a fortnight later than in the vale at their feet. The warmth of the London air opens the buds earlier. A southern wall, by reflecting heat, hastens the growth of vegetables near its foot. The warm spring too or river does not merely flow over the surface, but sinks largely into the land if it be at all porous, and *such* land is *most* benefited by irrigation; some of the best water-meadows being mere gravels, almost bare of soil. Thus the roots of the grass are kept in a state of genial warmth. But the conclusive argument, as appears to me, may be drawn from a very curious operation called Gurneyism, of which an account was given in the seventh volume of this Journal.

Mr. Gurney having observed, what many may have remarked, that wherever any loose object, a bare branch, or an old gate, lies on a meadow in March, the grass grows exuberantly beneath it, conceived the idea of spreading a field with straw, at the rate of about a ton to the acre, and thus promoting the growth of the grass. The scheme succeeded so well that it was adopted by many neighbouring farmers in Cornwall; and thus, curiously enough, a thin coat of dry straw produced the same effect which had hitherto been obtained only by a thin sheet of moving water. How, it may be asked, did the straw produce its effect? I can see but one way. Gardeners, it is well known, spread light nets over their young crops in order to protect them from morning frosts in the spring. This effect is clearly due to the interception of the radiation of heat. The earth is constantly sending forth, in a perpendicular direction upwards into empty space, especially when the sky is clear, its warmth derived from the sun, just as a stove darts its heat around it; but a very slight interruption, such as the gardener's net, is found to check the passage of the heat, and thus to prevent that morning frost on the surface so much dreaded by gardeners. Gurneyism must act in a like manner, though on a larger scale, by preventing the escape of the natural warmth from the soil of a meadow. Irrigation, we have had reason to conclude, acts by imparting to the meadow the superior warmth of the stream or the spring. The effect is the same: the mode of action is the same nearly. The difference is as between covering up a sick man with blankets, or placing him in a warm bath. The one is stronger treatment than the other, and so also irrigation acts in winter—Gurneyism only in spring. It may even be questioned, I think, whether irrigation do not also act in some degree by intercepting the radiation of heat. Mr. Gurney found that *round rods of transparent glass* suspended over grass acted as well as opaque bodies in promoting its growth. Is it not possible that the rippling water may act like these rods of glass? It is true that water, after passing over a portion of water-meadow, is found to have lost much of its power when turned over another portion. This we should expect, because in travelling over and through the ground it has parted with its native heat, and will produce a diminished effect. I believe that it produces still some effect, otherwise the conjecture must, of course, fall to the ground —the point need, however, not be pursued further.

But, it may be asked, if streams act by their warmth when turned over meadows, why do not all streams of the same temperature act equally well? Why are some streams better than others? Why do some not act at all? The answer, I believe, is this. Several foreign substances, present sometimes in streams, are found by experience to be noxious to vegetation. Thus it was mentioned above that water for irrigation should feel, in a practised hand, oily as well as warm. This oiliness, I suppose, is the same with what is commonly called softness, the opposite of hardness, which is caused by the presence of carbonic acid, of which latter quality the laundress also complains when the soap will not dissolve in her washing-tub without the aid of wood ashes or of soda. A spring which contains carbonic acid largely is a petrifying one. We have some streamlets in this neighbourhood which, for the first mile or two of their course, encrust their sides and bottoms with lime. Such are declared to be unfit for irrigation, why I know not, but so experience teaches. It is observed that the two favourable and the two unfavourable qualities are generally found together in springs; softness with warmth, and cold with hardness. Ochrey springs, having on their surface a film, which presents the colours of the rainbow, and containing iron, are said also to be injurious; though in one district this iridescence was mentioned to me as even a favourable sign for irrigation. There is another substance most certainly mischievous to vegetation—the matter suspended in bog-water. Such water is destructive to the growth of meadow-grass. Marsh peat is itself so highly injurious, that when marsh peat has been put by a mistake into flower-beds for the growth of rhododendrons, it destroyed the garden turf for some breadth on each border. But this is not a hopeless obstacle, though found in a stream. I have seen water which a year or two before dribbling from a bog had been worse than useless, now issuing from the drain-pipes of that bog, *itself* cultivated, and after resting in a reservoir, spreading verdure over a field lower down the hill-side. This vegetable extract, however, sometimes infects rivers themselves, as in the romantic scenery of West Somerset round Dulverton, a neighbourhood well known to fishermen. In that beautiful district, four mountain torrents, rushing in a perpetual fall along deep wooded valleys, join to form the river on which Exeter stands. The Haddyo has the finest trout, and is best for water-meadows. The Exe is moderate in both respects. The Barle has poor trout, and is useless, or if not utterly useless, is rated so low that other streams are carried over it by wooden aqueducts for irrigating the fields on its very banks. The Danesbrook has no trout, and is injurious upon meadows. The Barle and the Danesbrook,* though clear as crystal, are brown as a cairngorm with bog-water from Exmoor. When those moors are drained, the fish may yet thrive in their waters, and the winter's grass become green on their banks. It may be instructive to pursue

---

* I shall be forgiven for recalling to the reader that these four romantic streams have twice been admitted into English poetry—once by the late Dean of Manchester :—

"Oh, how I love the woody steeps to climb
Which overhang thy solitary stream,
Clear-flowing Barle! or tread the broken stones
Round which thy never-ceasing waters foam,
And ever and anon rough-tumbling roar
Beneath the oaken shade. . . . . .
And thou, romantic spot where close beneath
Mountsey's proud brow and Anstey's stately moor
Danesbrook and Barle their noisy streams unite :
Upon your sides abrupt the pausing eye
Dwells charmed as it views each sparkling spring
Shine through the gloomy woods and trickle down."

Miscellaneous Poetry, by Hon. and Rev. W. Herbert, 1801.

And once again, among a later generation, in the tender recollections of his boyhood, by a dear departed friend :—

"With beating heart how many a reckless day
Has marked my boyish step delighted bend
Where Haddon's heights of purple heath ascend,
Where Hawkridge' wild and sullen wastes extend :
And verdant Storridge to the thundering wave
His mighty mass of oaken forest gave
By Haddyo's foaming flood and Danesbrook's tide
That parted once a rival people's pride. . . . .
Here have I heard in summer's liveliest glow
Mid hail and mist the raging tempest blow,
Eternally on hoarse resounding shore
The infant Exe with tide impetuous roar.

. . . . .

In Pixton's woods the chase was fierce and strong ;
At night their limbs on couch of heather spread,
The mountain fern wild pillow for their head,
And, if they listed melody, might hear
Our rushing Barle make music for their ear."

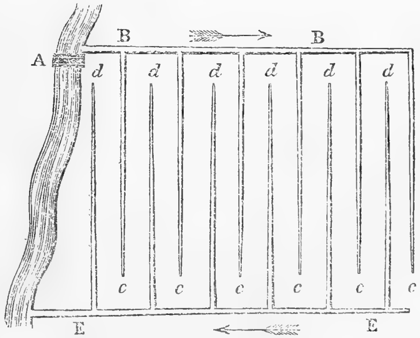
The Moor, by the late Earl of Carnarvon.

—Ph. Pusey.

the united streams further. The conjoint river is unfit for watering until it has received another stream of excellent quality near to Bampton, after which it is capable of being used not alone, indeed yet, but to assist in making up the volume of tributary streams which are diverted along its banks. When the Exe however, now a broad river, has passed through the busy town of Tiverton—every street of which has a running stream washing away the ordure—the Exe becomes again fertilizing, and meadows are formed to receive its waters. The theory of irrigation appears then to be this:—Water acts upon meadows by imparting its warmth to them; perhaps also as a covering, by enabling them to retain their own warmth. If the water contain mud or fine soil its action is stronger. If the drainings of yards or of towns, stronger still. On the other hand, the colder the stream the less likely it is to act, and its powers are weakened or destroyed by the presence of carbonic acid (by hardness), or of iron, or of tannin. The quality of the fish has been seen to indicate that of the water. A well-known herb, the *watercress*, is said to be an *unfailing* witness for the goodness of the stream along whose bottom it flourishes.

We may now turn from the theory to the practice of irrigation. Water-meadows are formed on two systems. In the southern counties, Hampshire, Berks, Wilts, Gloucester, and Dorset, the Itchin, the Kennet, the Avon, and other rivers, are diverted; and the neighbouring land being flat is entirely reshaped to receive them. The turf is pared. The whole surface is laid up in high regular ridges, about thirty feet wide, along whose summit the water runs in gutters, overflowing the sides to the bottom, where other gutters receive them and carry them off. In form the meadows are like the sea after a storm, when the long waves are subsiding.

Plan of Water-Meadow.

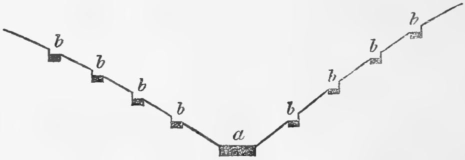


Section of Water-Meadow.

A. Dam across river. B. Main Carrier. *c*. Watering Gutters
d. Draining Gutters. E. Main Draining Gutter.

Those who are conversant with earth-works will see at once that to make a water-meadow on this plan must be an expensive process. Twenty pounds per acre would be a low average: thirty pounds not unusual. I remember having asked in Dorsetshire to see a cheap water-meadow, and being shown a field of eight or ten acres, which had just been made *at a cost of forty-five pounds for each acre.* Few new water-meadows, however, are any longer made in these southern counties, as the heavy expense of the system is barely compensated, now that the growth of green crops has supplied more food for flocks in March and April. It is to the south-west we must turn, to Somerset and to Devonshire, for patterns of future irrigation. In those two lovely counties, which have the valleys without the Alps of Switzerland, abundant streams roll cheerfully in a rapid descent over stones, or among mossy rocks, and the sheltered sides shelving rapidly upwards, have long since tempted the farmers to lead the water along their sloping face in tiers of channels, each of which receiving the overflow from above, as it begins to gather irregularly, receives it in a level trough to brim over anew, until it reaches the lowest channel, which delivers it back to the river's bed. The horseman as he rides along sees meadows of a few acres rising above his head, bright as emerald, glistening against the sun with their thin film of water, alternating with orchards in which cottages are nestled, that seem to cling to the hill, with a canopy of oak copse above, whose russet leaves, a remnant of the last summer, look the ruddier against the narrow space of blue sky that roofs in the glen. These are called catch-meadows, because each trench thus catches the water from its neighbour above it.

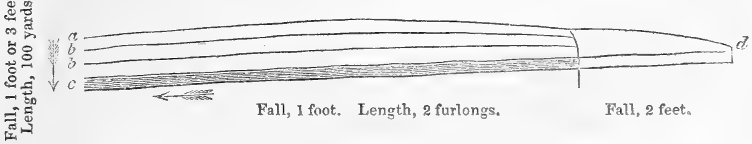
Section of Lower Part of a Valley.



a. Stream. *b.* Gutters.

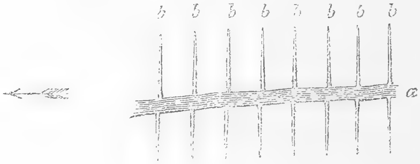
The catch-meadow is as cheap as the water-meadow is expensive to form. For the slope being already there, it is necessary but to take the levels for the gutters; which being done, these may be dug, and the surface be laid smooth, for two or three pounds per acre instead of twenty or thirty. I have seen near Winsford, a water-meadow on the hang of a hill so steep that one could scarcely climb it without help of the hands. It had been until lately rough furze ground. The tenant had given it rent free to a labourer for two years. The labourer broke it up, grew two crops of potatoes for himself, smoothed it, and actually cut the gutters, so that the farmer had converted moorland into rich grass at the cost only of a good dressing of lime which was given it. Many a hill-side in Cardiganshire, or Argyleshire, or Kerry, might be thus transmuted, if one energetic landowner would lead the way. Catch-meadows have been successfully formed in more level counties by the Duke of Portland, and by Lord Hatherton, who possessed natural slopes. But most English streams are sluggish, flowing through level tracts. It is distinctly stated in one of our best and handiest agricultural works, "The Dictionary of the Farm," by the late Mr. Rham, that "catchwork is only applicable where there is a considerable fall of water, and a gentle declivity towards the river." If this prevailing opinion be sound, a large part of England must remain without increase of its irrigation.

This opinion, however, is a mistake; for in Devonshire—the classic land of catch-meadows—catchwork has been lately applied to levels as flat as the banks of the Cherwell, and is spreading rapidly on such levels. At Killerton, near Exeter, Sir Thomas Acland has two wide catch-meadows, each of about 60 acres, without perceptible fall, called 'Wish meadows' and 'Beer-marshes' (in Devonshire a meadow means a water-meadow; a low unwatered grass-field is called a marsh), and Lord Poltimore, on a farm occupied by Mr. Norris, has a catch-meadow 3 furlongs long, with a fall in that distance of *only four inches and a half;* what is important, the land is irrigated in the line of this fall, that is, by cross gutters. For there are two falls we have to consider in catchwork, as in the quotation from Mr. Rham, the fall of the stream *onwards* and the fall of the land towards the stream *sideways.* The fall of the stream is required for diverting its water to a point from which it may run over the land: the fall of the land is required for carrying the water off from the land into a lower part of the stream. A stream might have but a slight fall, say a foot, in passing through a water-meadow a quarter of a mile long, yet if the neighbouring land shelved towards the stream, and if the meadow were but 200 yards broad with the stream in the middle, there would be a side fall for the water returning over the land into the stream equal to 1 foot in 300, though the fall of the river is assumed to be only 1 foot in 1320.



If a little higher up there were a fall of 2 feet, and the water could there be diverted, a *side* fall of 3 feet, or of 1 in 100, might be obtained on the water-meadow.

But if the land adjoining a stream do not shelve sideways, the only fall to be obtained will be in the direction of the river's descent, and that fall cannot be increased by damming the stream higher up. The gutters must be cut athwart the line of the river, and the course of the irrigating water must be in the same direction with the course of the stream thus,—



a. River. *b*. Watering gutters.

In this case it follows that the fall of the irrigated land cannot exceed the fall of the river. Since the fall of the river on this meadow of Lord Poltimore's is only 4½ inches in a course of 3 furlongs, or 1980 feet, and the course of irrigation is not lateral but direct, it follows that the fall of irrigation is but 1 in 5280. This is so wonderfully low, that unless the measurement had been given me by the person who laid it out I could not have believed it, for the fall considered desirable, if not necessary, on the old-fashioned system is about 1 in 18. A new meadow is now being made for Lord Poltimore where the river has a fall of 2½ feet only in half a mile length. On one side of the stream the field is 2 furlongs wide, so that even where the fall is lateral it will be but 2½ in 2 furlongs, or 1 in 528. Another is being made for Mr. Barber with the exceedingly low fall of 2½ inches in 2½ furlongs. This is a direct irrigation. The fall of *one inch in a furlong*, or 1 in 7920, is remarkable even according to the new system of Devonshire. There is indeed one *old* meadow near Crediton exceedingly flat, so flat that, as the stream which waters it brings down large quantities of mould from the hills, as well as refuse from the town, the land rises rapidly, and in order to keep down the levels the surface has been removed twice in seven years to a depth of 2 feet, to be carted off as a top-dressing for other fields. These flat meadows are now spreading widely in South Devon. That they pay for their formation there can be no doubt, costing from three to four pounds an acre to form, and yielding three pounds of rent, whereof two pounds may be taken as the new value imparted by the operation. This, for an average rate of profit, is a very high one. In single cases it is exceeded. About two miles from Exeter there is a small property of 156 acres, all but eight of which, that are orchard-ground, are watered by two moderate brooks. *It is let at more than six pounds an acre all round* to different occupiers. Three acres, worth naturally three pounds an acre, let at *ten* pounds, six acres at eight pounds per acre. The whole was worth about two pounds an acre originally, and the portion recently made cost about three pounds twelve shillings per acre to form. These are actual *lettings*. The Clipstone water-meadows are *valued* by Mr. Denison at eleven pounds fourteen shillings per acre yearly, without allowance for rates and taxes. They are, indeed, a noble creation of the Duke of Portland's. Great difficulties have been overcome, and great perfection attained. As you wind up the valley you see nothing but one universal luxuriant tapestry of grass spread on each side along the well-moulded slopes—

> " Hic ver assiduum atque *alienis* mensibus æstas."
>
> " The fields here Spring's perpetual beauties crown,
> Here Summer shines in seasons not her own." *

This work, however, cost his Grace *one hundred and thirty pounds* per acre in forming, or 39,297*l.* for 300 acres—a price few could afford. In the above case from the neighbourhood of Exeter, we have the value not merely estimated, but realized in the form of rent, and the cost insignificant. If I dwell often on cheapness of construction in farming it is because no improvement can become general if it be not also cheap. It is by reducing the cost of production that the Lancashire manufacturers have sent our cottons round the whole world.

As to the management of the catch-meadows in Devonshire, the watering is begun in autumn with the heavy rains, and great importance is attached to these first floodings. Sometimes the use of a stream is divided among neighbouring farmers by periods of three days. I have been told by one who contracts to keep such meadows in order, that when an unneighbourly farmer insists on keeping his water for the full term, that is till midnight, my informant is obliged to remain out half the night, perhaps wet to his skin, setting the bays and distributing the water on the land of the next recipient, who, he says, might lose ten shillings an acre if he waited till morning. So much value does the experience of Devonshire attach to water.

Sometimes a crop of feed is forced before Christmas; but in general the water is so shifted, that the strength of the land and the grass may be reserved for an early crop, which in Devonshire is often ready by the end of February. If the ewes are admitted into a field on the 1st of March, they feed it down perhaps in a fortnight, and are removed. The water is let in, and kept on

---

* Warton's Virgil.

for a fortnight; after a few days there is a good bite of grass, and the ewes are let in once more. Sometimes on good land, and in good seasons, a third crop even of feed is grown before the land is laid up for hay, which is generally done on the 1st of May; in six weeks from that time, by the middle of June, the hay is ready to cut. Afterwards the meadow is "damped," that is, watered for about three days. A longer watering is improper in warm weather, as it leaves a white scum on the land, the dried remains of the same loose green vegetable matter (a *conferva*), which is often seen in stagnant ditches.

Such being the cheapness and such the advantages of the *level* catch-meadow in Devonshire, it becomes an important question whether the system would answer generally in the south of England. A *question* it is certainly, for the marked difference of climate forbids us to form a peremptory conclusion.

It is well known now, that the western sides of both England and Ireland are more favourable to grass than the eastern sides; the western breezes being loaded with vapour which, whether retained in its invisible form or condensed as rain, is most propitious to vegetation. The air too is warmer in winter, and, the sky being more clouded, the sun less scorching in summer. On a naked field it is as difficult to check the natural grasses in Devonshire as to bring a turf, if wanted, in Berkshire. Severe frosts too are much less frequent in Devonshire, as well in winter as spring, at which latter period they destroy grass which has been forced forwards, unless its roots be well covered with running water. Two years since, however, I determined to try the experiment in Berkshire, and secured the assistance of an experienced "gutterer" (as the makers of water-meadows are called in Devonshire), Mr. Ley, of Newton St. Cyr, near Exeter, who with his son had laid out the meadows instanced above for their exceedingly low gradients—a matter of the nicest skill in agricultural engineering. His son formed for me sixty acres, at a contract price of 4*l.* per acre, to which price must be added 30*s.* an acre for bringing water from the streams, and for trunks and sluices. Much of this land is flat, and there is also a great scarcity of water. Catchwork, it should be remarked, has the further advantage, that it works not only with little *fall*, but with little *water*, as upon fields almost level the water with so slight a fall flows very slowly. The water is also spread very *thinly*. Mr. Ley says that, if a catch-meadow be laid out well, you ought to be able to walk across it, while the water is on, without wetting your feet. This perhaps is a figure of speech, but it illustrates the point. The meadows were completed early in 1848; but appeared, excepting one small field, to be *a total failure*. The crop was not earlier than in other years. Mr. J. Ley accounted for the deficiency by the natural poverty of the soil, and its want of condition. Both these imputations were just; but the undertaking seemed hopeless enough. I dwell upon the circumstance, because it may be useful to others. It seems to be a principle that irrigation may gradually raise the condition of land, but requires either good land or fair condition to produce a marked immediate effect. One field looked decidedly worse than before, because there had been previously more moss than grass on it, and the moss had been killed by the water. But on the worst part of that field the ashes of some burnt bull-peats or hassock-grass had been spread, and a luxuriant crop of grass had sprung up. The hint was taken, and there being peat at command for burning, a liberal dose of ashes was applied in March, 1849. The effect was marvellous, especially on some worn out rye-grass, which is now full of young clover and is become at once a *close sward.* This is not the case where *either* the ashes or the water have been deficient. Here is a remarkable agreement with what is said of Gurneyism in the following passage:*—

> "Many experiments were made. The results of those experiments were very interesting. They showed that the action was general; that the difference in growth in a given time was *in proportion* to the natural *fertility* of the soil. On some of the coarse moors where experiments were tried, the increase of growth was very slow as compared to better soils. It was found that the rate of action was also influenced by *artificial manuring*, and that the increase of vegetation was in a *ratio* with the natural quantity that would be produced by a given manure when laid on a field, and not assisted by the operation of any fibrous covering. A certain quantity of stall-dung, which would *double* the quantity of grass in a given time when laid on in the usual way, was found to increase it to *six* times when properly treated with fibrous covering."

It appears to me that in irrigation also the water does not merely add to the produce, but tends to double or treble it. If the produce by other means be half a ton, water will make it one ton. If the produce be one ton, it will become two tons by irrigation; a remarkable agreement with the action of fibrous covering, and a great encouragement to maintain or to raise the condition of water-meadows.

In one way or other, partly by ashing the land, partly by the irrigation alone, an entire change was made by last spring. The grass grew so rapidly that we could not feed it all off, and were obliged unwillingly to make much of it into hay. I say unwillingly, because to carry off a crop of hay is of course not the way to raise the condition of the land. As far as possible, however, sheep were penned regularly over the new catch-meadows, in general three times successively on the same land, and partly with artificial food because they were new and poor; but to show

---

* Journal of Royal Agricultural Society, Vol. vii. p. 279.

the amount of stock kept, I will give the account of sheep folded on a small field without other food. The field is under two acres, better land than the rest, but so much out of condition that latterly the hay-crop had been hardly worth cutting.

	Day's keep of a Sheep.
First penning, sheep put on, but grass too strong to feed, and made into hay, say only	3,000
Second feeding, 400 lambs for eight days, say 240 sheep	1,920
Third penning, 250 sheep for ten days	2,500
Fourth ditto, 250 sheep, fourteen days	3,500
	10,920

The total amounts to 5 months' keep for 73 sheep on two acres, *thirty-six* sheep to an acre.

The calculation is made for five months, because that is the period for which the wintering of sheep on turnips is reckoned. A thoroughly good crop of turnips is said in Lincolnshire to keep *ten* sheep an acre for five months. It is difficult to find a standard of comparison upon grass-land, because beasts and sheep are usually grazed together. I know one instance, however, in which sheep were fattened on grass-land in the five summer months at the rate of *seven* sheep to an acre, and the number was thought to be large. This might be equal, however, to *fourteen* sheep of mine, which were merely kept in store order. Still the account would stand thus: *fourteen* sheep kept on an acre of superior grazing land unwatered, *thirty-six* sheep on an acre of moderate land watered. The very high rate of my sheep to the acre certainly surprises me, but the figures are perfectly accurate. The large number may be partly accounted for by a peculiarity of the management, namely, that the sheep were folded not only for the first time, but every time after, instead of roaming at large. In his report upon Gloucestershire, Mr. Bravender mentions that a farmer who adopted this system found an increase of twenty per cent. in the number of sheep he could keep on his farm. This point seems to deserve attention, *independently* of irrigation. The allowance of 20 per cent. for folding would still leave the numbers at 14 and 29. But as sheep at turnips are equally folded, the comparative numbers per acre will there stand at *thirty-six* and at *ten*, not to mention the expense of cultivation for turnips, and the absence of labour on water-meadows once formed. This meadow is a very flat one; in fact before it was levelled it appeared to have no fall; there is a fall however of 3 feet 8 inches in 140 yards, or 1 in 114. I mention this because the most doubtful point for our cold counties seems to me to be the slow fall, and hitherto certainly a fall six times sharper, has been thought requisite. On other parts of my new meadows a much lower fall is found sufficient.

As in other branches of farming, so in the management of water-meadows, constant attention and the master's eye are essential to complete success. Even in Devonshire, where all understand water-meadows, the farmer's management materially affects their production. The plan of repeated folding has answered, as has been seen, with me hitherto. On many water-meadows, where the animals roam at large, they neglect to eat portions of the field which thus become rank. Besides, the droppings are distributed more equally. One agricultural work intimates that there is danger of rot in feeding sheep on water-meadows during summer. In Devonshire, I am told, they have no such fear, nor have I suffered by it as yet; but I gave my sheep large lumps of rock salt to lick constantly in their folds. The danger may arise from *improper* flooding in summer, or it may be a real risk, and I therefore mention it. It certainly occurred on a part of the Clipstone meadows. In new water-meadows which require to be raised in condition, I should particularly recommend it as a cheap way of effecting that object. Probably, if continued in after years, it might raise the condition to too high a point; in order to lower which it might be necessary that a crop of hay should be severed and carried off in the usual manner. The yield of food for sheep would be, of course, the same, though in a different form. I should also recommend folding when ashes are applied to the land: as ashes being what was called formerly a stimulant, a manure of quick but passing action, might impoverish the land if the sudden crop produced by them were carried off. If the grass be fed off on the land, the extra produce is returned to it, and a solid foundation of future high condition is laid.

There is another point of detail which appears to answer. In folding the sheep I endeavour to have the hurdles so set that on each day, or second day, as they are shifted forwards, the water may be passed over the recently manured land. Every one knows the strong smell of a sheep-fold. Without entering upon the power of water to fix ammonia, a substance on which it is dangerous unless for a chemist to enter, and which led even Liebig astray, there is no doubt that the water thus following destroys the stench and must therefore distribute the manure. In fact, when this is carefully done no spots of dark herbage are seen to arise from the droppings. The water carries the salts *down* among the roots of the plants: for a great deal of the water sinks *into* the earth. When land is formed into water-meadow it is rather disheartening for a beginner to see a strong stream sink for days into the bottom of the carrier without overflowing at all; and when it does at last overflow, to see it creep over the land, advancing but a few inches perhaps in an hour. Even though the stream be strong it sinks through the worm-holes, from which the escape of the air-bubbles produces a general noise like the distant singing of birds; the ground indeed is said to *sing*. The worms however die (they are found dead in large numbers), and the pores of the earth are gradually filled up by fine particles of soil carried down by the water. It is a good sign when the water begins to lie in the bottom of the gutters after the stream is drawn off. This effect may be anticipated by rendering the water muddy where that is possible, or, according to Mr. Roales in his Prize Essay, by spreading fine earth on the surface.

Still a great deal of water is drunk by the land, and this circumstance may be made serviceable. In summer only "damping," as it is called, is allowable. Here, however, in a dry summer we have not water enough even for damping. But by leaving the gutters brimfull, so that the whole stream might be absorbed in the channels, I was enabled to make the most of the dribbling brook which the long drought had left, and to keep some very dry land green and grassy, while other pastures were parched and had ceased growing. For our inland counties, which are subject in summer to constant droughts, I believe that this power of keeping the land moist would *alone go far to pay the cost of making a catch-meadow*.

There is another use which may be made of water-meadows. The two streams employed here I have turned through two of the farm-yards. The cattle in these yards are kept loose, even while fattening, in the old-fashioned way, though tied up at feeding-time. When heavy rains come, the muck-water is washed down into the passing stream, and distributed over the meadow without labour to man or to horse. In this case, and whenever a reservoir is filled with black water from other yards, as happens in sudden rains, the manager is desired to put only so much of this rich water on a piece of the ground as will sink into it, and then to turn the dark liquor over a fresh portion of meadow. This is done lest the soluble salts should be carried away over the surface of the field into the stream, and so wasted. As to the winter management of the water it may generally be left on any particular portion for a fortnight at once. When the grass turns dark, the water should be taken off. A standard Scotch work on farming directs that it should be taken off on the arrival of frost. The true rule, however, at least in Devonshire, is not to *take it off* nor to *lay it on* in a frost;—not to take it off, because the water freezing on the ground forms a coat of ice which protects the grass exactly as a covering of snow guards the young wheat,—not to lay it on, because the ground, being already frozen, can be no longer protected.

There is a novel use of irrigation which I may be permitted to mention, as it has answered in the only experiment I have hitherto made—the application, I mean, of artificial manures. The two chosen were—guano, as an universal manure; and sulphate of ammonia, the refuse, I believe, of gas-works, as being the most likely of chemical salts to favour the growth of grass. The guano was applied by mixing it in the gutter as the water was laid on; the ammonia by distributing it along the edge of the same gutter in another part, where it was rapidly dissolved by the water. Both applications have succeeded: the *chemical salt* answered the *best*. The land should be previously dry, that the solution may enter it.

It may now be convenient, perhaps, to sum up shortly some of the practical points mentioned above.

It is clear that in the moist climate of Devonshire the system of catchwork which originated on steep slopes has been gradually transferred to land which an unpractised eye would regard as a dead flat.

It appears also that this inexpensive method of irrigation may be transferred in *some* degree to our drier and colder inland counties, though caution is still necessary, as Mr. Denison says, that at Clipstone Park, 1 in 9 is the best fall, and that very flat lands will not answer for irrigation. Clipstone Park, however, is far towards the north. The degree of fall suited for each shade of climate is matter for further trial. It should be observed, that since the Devonshire system does not profess to recast the land on a perfect model, but only to effect its object by using and improving the natural irregularities of the surface, the distribution of the water on the level catch-meadows will not be perfect at first; but a constant improvement may be made in these meadows by rolling them while they are wet, and by using the earth which is taken out of the gutters in cleansing them every autumn, for raising gradually any spots where the water lodges.

It should also be remembered that land, if at all unsound, must be underdrained when it is irrigated, and the drains must be larger than ordinary, as Mr. Denison informs us in the excellent paper* to which reference has already been made. The drains should be laid so that the water issuing from them may be made to flow again over on a lower part of the meadow. Drains are the only source of water on Lord Hatherton's meadows at Teddesley.

The safest mode of agricultural improvement is, not the adoption of entirely new principles or contrivances, but the cautious yet courageous development of existing practice. The level catch-meadow is clearly a promising ground to be worked out; and in

---

* See Journal, vol. i.

endeavouring to carry it further, the following points should, I think, be attended to:—

1. The increased use of folding for sheep.
2. The conveyance of the stream through farmyards, as the simplest method of preventing the waste of manure.
3. The rapid application of the water as the sheep-pens are shifted, for preventing the waste of manure deposited on the land.
4. The increased use of the water for maintaining vegetation during the droughts of summer.
5. The use of the water for diffusing chemical manures on the land watered.
6. The cultivation of Italian rye-grass, which grows three times as rapidly as the common meadow grasses under the influence of irrigation.
7. It being necessary, where the stream is scanty, to form a reservoir, the ornamental sheets of parks may be used for the purpose, by placing, as I have done, an additional but removable board on the sluice-gate, so as to raise the pond occasionally a few inches above its level —a considerable rise for the purpose, if the sheet of water be at all extensive.

There is nothing more that I need now add. I will not pretend to teach how catch-meadows are to be made. Since the natural irregularities of the ground, which an unpractised eye would overlook, are to be used for distributing the water, the work must be left to a professional manager, as in Devonshire. Even among "gutterers" there is great difference of skill; thus it is said of Mr. Ley, that his eye is better than many another man's level. I have proved what I set out by promising, that money expended on catch-meadows may pay 30 or even 50 per cent.; and as the work is done by contract, there can be no error as to its cost. In any branch of manufacture, to prove this fact would be to ensure its immediate accomplishment. If such a profit were likely to arise from cutting through the Isthmus of Suez or Panama the canals would be dug at once. Much more persuasion I know is needed in stimulating landlords to the improvement of even English estates. I will only say that it is mainly these catch-meadows which enable me to keep a flock of 550 ewes, and winter their lambs also, on nearly the same farm upon which my predecessor kept 170 ewes with their lambs. There is one test, however, often applied by farmers, when a person adopts and recommends some improvement in farming. They ask the question,—Has he gone on with it? This is a very good test, for there are many disappointments in new systems of farming. I may therefore be allowed to mention, that having last year suspended any fresh plan of irrigation, on account of the apparent failure of those which were already executed, I have contracted this winter for 26 acres of catch-meadow to be made at 3*l.* 10*s.*, and 30 more at only 2*l.* an acre. But what is described gives no clear impression; a work of art must be seen. Next year, however, our Society meets at Exeter. July, indeed, is not a good season for seeing catch-meadows, as the water is not upon them, and the grass wears no unusual verdure. Still the method of irrigation may be even then understood, and some one of the meadows could easily be watered slightly for the inspection of visitors. To see what might be done in Wales or in Scotland, the owners of mountain properties might make a pleasant excursion along the Exe towards its source northwards. The scenery will beguile the way, and near the Bristol Channel they will find excellent samples of hill-side catch-meadows about Timberscombe and upon Dunkerry not much below the Beacon. For level meadows the patterns are to be found within ten miles of Exeter, and I hope that they will not be seen in vain by English gentlemen having villagers without winter work, as who of us is there that has not?

PUSEY, *Nov.* 23, 1849.

XXIV.—*On the Composition of Linseed Oil-Cake, Beans and Peas, &c.* By J. THOMAS WAY, Consulting Chemist to the Society.

THE consumers of linseed-cake in this country are almost unanimous in the belief that the different samples of this article are of very varying value as food for stock. Where such an opinion as this is general, it would argue little wisdom to dispute its correctness: it only remains to investigate the cause.

When linseed, ground into coarse powder and digested with a small quantity of water, with the aid of heat, is exposed to strong pressure, two products are obtained—the one, an oil of well-known characters, linseed oil; the other, the cake which remains in the presses. No other substance but oil* is separated from the cake; and the two products, therefore, correctly represent the composition of the seed from which they are derived. Linseed is known to consist principally of mucilage, or gum, sugar, oil, and albuminous matter—the three former being substances devoid of nitrogen, the latter having the same composition as the flesh of animals, or the gluten of wheat. Now as linseed oil contains

---

* Unless it be some very small quantity of water.

no nitrogen, it is obvious that the cake must be richer than the seed in albuminous principles in the exact proportion of the oil which it has lost by pressure. Given, then, the composition of any sample of seed, and the quantity of oil which is expressed from it, we have by the simplest calculation the composition of the cake. In the present inquiry the order of procedure has been reversed: instead of starting with the examination of linseed, and speculating from the results upon the necessary composition of the cake produced, I have applied myself first to ascertain whether, in samples of cake taken carefully but indiscriminately from commercial sources, there existed *chemical* differences sufficient to account for the variations in feeding qualities observed by the farmer. Not disputing, as I before said, that such superiority of one sample over another was a *fact*, it yet seemed gratuitous in the outset to allow that it resulted from difference of composition.

There are indeed two distinct circumstances which might influence the value of cake, independently of its chemical characters:—the flavour, which is more or less agreeable to stock, and the state of division—the fineness or otherwise to which the seed is ground. To this latter circumstance, in all probability, very great differences in the feeding properties of specimens of cake might with justice be referred. Mr. H. S. Thompson published some time ago experiments made by him upon the relative merits of using linseed whole and crushed.

He found that of linseed used in its entire state, a very considerable proportion passed through the stomach of the animal undigested, being present in the dung, and apparently in an unaltered condition. The same result in kind, though not in degree, might be expected to occur in the case of linseed-meal of various degrees of fineness, and with greater reason in cake, the particles of which in addition are, by the extent of pressure to which they have been subjected, closely compacted together.

Both these causes of variation—the mechanical condition of the cake and its flavour—lie, however, out of my province, which is confined to the chemical composition of the substance in question.

1st., then, we must inquire, Is there any real difference in the chemical composition of various cakes; and if so, does the distinction apply to those of different manufacture or origin?

2nd. Is the difference (supposing there to be any) sufficient to account for the observed effects in feeding?

And 3rd. Is it to be attributed to adulteration, or to necessary variation in the composition of the seed?

These three points of inquiry will, it is believed, successively develope themselves as we proceed to detail the analyses.

I should here state to what kind of analysis the inquiry has been limited. Linseed, as before mentioned, contains albuminous matter, oil, mucilage, and sugar, together with a certain quantity of mineral matter, or "ash."

The mucilage (or gum) and the sugar have no doubt their share in the value of the cake as food. It is indeed contended by some that sugar serves in the animal to the production of fat: they are more usually, however, considered in the light of "elements of respiration" only, and not as employed either in the formation of flesh or fat. And holding, as is generally done by chemists of the present day, the doctrine of the simplest *adoption*, so to speak, of the vegetable principles into the animal frame—the more nearly allied to each other, the less being the effort on the part of the system—it is hard to believe that, in the presence of oil in abundance, nature should have recourse to sugar for the production of fat.

The quantity of oil, as representing the fat-forming principle, and of albuminous matter, as indicating the *feeding* qualities, seemed the points of principal importance in the chemical history of linseed-cake. With these it appeared important to ascertain the per-centage of ash, in order that any introduction, accidental or intentional, of sand or other inorganic matter might be detected.

The quantity of albuminous matter in vegetable substances is now usually estimated by the proportion of *nitrogen* which they yield. The different modifications of albumen, gluten, casein, &c., are, with one exception, so nearly alike in composition (containing about 15·75 per cent. of nitrogen) that it is more exact to determine their proportion by that of the distinctive element (nitrogen) than by recourse to methods for the separation of the proximate principles themselves. It is not doubted that a *full* analysis of linseed-cake, as well as of the other vegetable substances used in feeding cattle, would be a great boon to agriculture; but in the existing state of knowledge as to the relative offices of different constituents in the production of muscle and fat, the present inquiry has appeared to offer advantages, as embracing a far larger number of specimens than could be examined in a more detailed form.

The larger number of the analyses of linseed and oil-cake that follow were made by Mr. Ogston in my laboratory; some few, however, having been executed by Mr. Ward and Mr. F. Eggar. Of the nitrogen, a duplicate determination has in all cases been made; and, both to give confidence in the results and to impress upon the present contribution that air of exactness which should never be wanting in chemical papers, wheresoever they may be published, I have made a point of recording the double result. It has not appeared necessary to make a second analysis for oil;* but some cases are mentioned which show that the liability to error is not great.†

In order that any differences between the varieties of cake might be perceived, I have grouped them according to the different countries from which they were imported.

The first table contains the analyses of eight specimens of French cake, all of them imported this year, and the growth of 1848.

TABLE I.—Analyses of French Linseed Cake.

	NITROGEN.			Oil.	Water.	Ash.
	1st Analysis.	2nd Analysis.	Mean.			
No. 1.	4·61	4·56	4·58	9·77	6·96	21·62
No. 2.	3·89	4·08	3·98	7·45	7·48	22·66
No. 3. Dunkirk . .	4·45	4·82	4·63	10·12	7·20	8·72
No. 4. Treport . .	4·66	4·78	4·72	10·16	7·32	7·61
No. 5. Bordeaux . .	4·65	4·56	4·61	9·99	8·16	8·08
No. 6. Marseilles . .	4·61	4·58	4·59	9·67	7·50	8·02
No. 7. Marseilles . .	4·98	4·94	4·96	8·40	7·85	7·25
No. 8. Marseilles . .	5·68	5·76	5·72	7·89	8·31	7·66

Any remarks about the extent of variation will come better when the whole evidence is before us; in the meanwhile, the *mean* composition of the above may be given.

In the Table is one very high and one equally low per-centage of nitrogen. These will in great measure balance each other, and not greatly affect the result. The mean of eight specimens of French cake is—

Nitrogen	4·72 per cent.
Oil	9·06
Water	7·60
Ash (omitting Nos. 1 and 2) .	7·89

---

* The oil was obtained by extraction with ether in the usual way.

† It may appear to some unnecessary and objectionable that the pages of the Journal should be occupied with the *detail* of experiments where the *results* only are immediately serviceable. To these it must be answered, that in all scientific journals it is usual to give the most minute details, in order that the reader may possess ample means of discovering error, whether of experiment, calculation, or opinion; and this amplification forms, in the eyes of the scientific man, an indispensable requisite of scientific writing. Neither is it just to the writer that the evidences of his labour should in large measure be suppressed, for it must be remembered that, when the *results* of a research have been published in this Journal, the *details* are of no value to any other; and as they would never meet the public eye, all trace of them would be eventually lost. These remarks apply more to other instances than the present, where the double results, being tabulated, occupy no additional space.

The next Table gives the analyses of seven specimens of American cake :—

TABLE 2.—Analyses of American Linseed Cake.

	NITROGEN.			Oil.	Water.	Ash.
	1st Analysis.	2nd Analysis.	Mean.			
No. 9.	4·58	..	4·58	13·04	7·63	6·49
No. 10.	4·09	4·10	4·10	13·57	9·51	7·56
No. 11.	5·30	5·19	5·25	10·71	6·56	5·76
No. 12.	4·59	4·68	4·63	11·49	7·53	5·67
No. 13.	4·86	4·96	4·91	7·45	8·81	6·04
No. 14.	4·91	4·79	4·85	11·51	7·06	7·15
No. 15. New Orleans	4·85	..	4·85	12·11	6·09	5·78

We may fairly take the mean of the nitrogen in this table without the exclusion of any one specimen.

The mean of seven specimens of American cake will be—

Nitrogen	4·74
Oil	11·41
Water	7·60
Ash	6·35

The next table gives the composition of nine specimens of English cake. I am unable to say how many of these cakes were made from foreign seed—no doubt the greater number. They were all pressed at home.

TABLE 3.—Analyses of English Linseed Cake.

	NITROGEN.			Oil.	Water.	Ash.
	1st Analysis.	2nd Analysis.	Mean.			
No. 16.	3·91	3·94	3·92	16·55	8·23	6·18
No. 17.	4·29	4·18	4·23	13·43	8·66	6·92
No. 18.	4·94	4·84	4·99	13·88	8·83	6·90
No. 19.	5·04	5·12	5·08	13·34	9·38	8·04
No. 20.	4·95	4·85	4·90	14·33	8·10	7·54
No. 21.	4·55	4·47	4·51	10·05	9·25	6·94
No. 22.	3·93	..	3·93	16·10	10·26	5·45
No. 23. From Russian seed . .	4·31	4·27	4·29	11·28	7·20	9·63
No. 24.	4·62	..	4·62	15·32	7·51	6·04

The mean of the foregoing specimens of English cake is, for the

Nitrogen	4·57
Oil	13·52
Water	8·60
Ash	7·27

The nitrogen is, on the aveage of these specimens, somewhat lower than in the case of the French and American series; but this arises from the extreme lowness of specimens Nos. 16 and 22. If these be thrown out, the average on the remaining seven samples will be 4·66, which practically does not differ from the mean of the French and American. Of the other varieties I have fewer samples to describe.

The following are analyses of two specimens of Russian cake :—

Table 4.—Analyses of Russian Linseed Cake.

	NITROGEN.			Oil.	Water.	Ash.
	1st Analysis.	2nd Analysis.	Mean.			
No. 25	5·08	4·92	5·00	11·83	8·84	8·67
No. 26	5·21	5·36	5·28	11·89	8·92	6·21

Mean of the two Russian Cakes :—

Nitrogen	5·14
Oil	11·86
Water	8·88
Ash	8·39

Table 5.—Analyses of German and Dutch Linseed Cake.

	NITROGEN.			Oil.	Water.	Ash.
	1st Analysis.	2nd Analysis.	Mean.			
No. 27. German .	4·88	4·79	4·84	10·62	7·54	9·05
No. 28. German .	4·81	4·90	4·85	8·58	8·11	8·54
No. 29. Dutch . .	4·23	4·30	4·26	10·33	8·29	11·11

Mean of the three Specimens of German and Dutch Cake.

Nitrogen	4.65
Oil	9·84
Water	7·98
Ash	9·56

Table 6.—Analyses of Italian Linseed Cake.

	NITROGEN.			Oil.	Water.	Ash.
	1st Analysis.	2nd Analysis.	Mean.			
No. 30. Genoa . .	4·77	4·88	4·82	12·34	8·77	8·37
No. 31. Genoa . .	5·33	5·38	5·35	11·32	9·29	6·74

Mean of two Italian Cakes.

Nitrogen	5·03
Oil	11·84
Water	9·03
Ash	7·55

TABLE 7.—Analyses of Sicilian Linseed Cake.

	NITROGEN.			Oil.	Water.	Ash.
	1st Analysis.	2nd Analysis.	Mean.			
No. 32	4·40	4·39	4·40	6·60	8·97	8·53
No. 33	5·03	5·05	5 04	7·00	9·96	7·51

Mean of two Sicilian Cakes:—

Nitrogen	4·72
Oil	6·80
Water	9·46
Ash	8·02

The preceding tables present one specimen of cake (No. 16) with 3·92 per cent., and another (No. 8) with 5·72 per cent. of nitrogen.

Calculating from these data the quantity of *albuminous* * ingredients, we shall find that No. 16 will contain 24·9 per cent., whilst No. 8 will contain as much as 36·3 per cent., or in other words, it is possible to meet with specimens of which one has half as much again of the "flesh-forming principles" as another. It is not certain even that the extreme limits of variation may have been reached in either of these cases; but I do not imagine that it is usual to meet with them either so poor or rich as the samples in question.

It may be asked, Is this variation sufficient to account for the different results obtained in feeding with oil-cake? The question is only to be answered by another: Do we possess trustworthy numerical data of these results? The above variation in the composition of oil-cake is undoubtedly great, and would, I think, go far to explain the matter if it were at all common, which it is not.

Of the thirty-three specimens examined, twenty-one, or two-thirds, afford quantities of nitrogen varying only between 4·5 and 5·0 per cent.; whilst of the whole number only two are to be found under 4·0 per cent., and four sensibly above 5·0 per cent As I before remarked, it is impossible to say whether the difference in composition sufficiently explains the difference in feeding

---

* The expression is used in a general sense, without reference to the particular forms of nitrogenized principles.

qualities, whilst the latter is not capable of being expressed even approximately in figures. It must, therefore, for the present, be left to the intelligent farmer to decide for himself upon this point.

The per-centage of *oil* is more *uniformly* variable, if we may so speak. The extremes are found in No. 16, which contains 16·55 per cent., and No. 32, where it is only 6·60. Between these points the samples present every degree of variation, although in this respect the cakes of different countries possess well marked peculiarities.

In order that the reader may trace the above-mentioned difference, and that he may also observe the absence of any such distinction in the case of nitrogen, I shall offer a table of the average composition of the specimens from different sources.

TABLE 8.—Mean Composition of Linseed Cake from different countries :—

		Nitrogen.	Oil.	Water.	Ash.
French . . .	8 specimens	4·72	9·06	7·60	7·89
American . .	7 ,,	4·74	11·41	7·60	6·35
English . . .	9 ,,	4·57	13·52	8·60	7·27
German and Dutch	3 ,,	4·65	9·84	7·98	9·56
Russian . . .	2 ,,	5·14	11·86	8·88	8·39
Italian . . .	2 ,,	5·03	11·84	9·03	7·55
Sicilian . . .	2 ,,	4·72	6·80	9.46	8·02

From this statement it would appear very evident that the specimens of French, American, English, German, and Sicilian cakes are *on the average* practically alike in regard to nitrogen. Neither should we be inclined to believe that the Russian or Italian would have furnished an exception to this rule, had a sufficient number of samples been examined.

On the other hand, there is an obvious difference between the quantity of oil in the cakes of different countries. To instance only those of American, French, and English manufacture, which are sufficiently numerous to afford an average :—In French we have 9, in American 11½, and in English 13½ per cent. of oil ; that is to say, English cake contains on the average half as much again. Neither is this peculiarity irregular, as in the case of the nitrogen. Of eight specimens of French cake, no case occurs of a greater proportion of oil than 10 per cent., whilst this number expresses the least per-centage of nine English cakes. This circumstance, which, from the great perfection of English machinery, we should have been at first unprepared to expect, will go far to explain the superior softness and mellowness of English-made cake. How far it may influence the fattening properties I cannot pretend to say. It hardly admits of a doubt that, to obtain the greatest advantage from a given weight of food, either in feeding or fattening, it is necessary that the flesh-forming, fat-producing, and heat-evolving principles should bear a certain proportion to each other.* Of what that proportion may be, we are at present ignorant. Practical men are nearly agreed that, in linseed itself, the quantity of oil is, in relation to the nitrogen, too great for the general purposes of cattle-food, and that the two ingredients are better proportioned in cake; but it does not follow that 13 per cent. may not be a more advantageous proportion than 9; and although an opinion on this subject would be premature, I would suggest to the intelligent farmer to bear this peculiarity in mind in any trials which he may institute between the cakes of different countries.

Having by the preceding analyses given answers to the first and second points of inquiry which were proposed in the commencement, namely, first, whether there existed any real difference in chemical composition, and if so, whether there was any marked distinction between the cakes of different countries, and secondly, whether the variation was sufficient to account for observed effects in feeding, we may pass on to inquire, thirdly, Is the difference attributable to adulteration, or to necessary variation in the composition of the seed?

Adulteration might be effected in two ways, either by admixture with the cake of sand or other earthy matter, or of sawdust, bran, or other vegetable substance.

I omit in this place the deterioration produced by the use of mixed and badly harvested seed; for although no doubt this is of very common occurrence, and very prejudicial to the interests of the consumers of cake, it is hardly to be called *adulteration*—a term which we apply to the wilful and dishonest falsification of any article of commerce: but of this there will be presently occasion to speak.

In the first place, then, Is cake ever adulterated with sand or earthy matter? Farmers are in the habit of taking a portion between their teeth, and, should they find it "gritty," believe that it is so adulterated. To me it has always seemed unlikely that the cake-manufacturers should resort to so clumsy a method of falsification, because, if the mixture of sand should be made with the meal during the earlier pressings, it would not only diminish greatly the yield of oil, but would increase to an important extent the labour of its extraction. If, on the other hand, the mixture were reserved till after the complete extraction of the oil, it would demand an additional pressing. Unless, therefore,

---

* See Mr. Lawes's paper on Sheep-Feeding in the last (July) Number of this Journal.

the per-centage of sand or earthy matter introduced were very considerable, the manufacturer would hardly find his account in such adulteration. So much for speculation. Let us now look at the analyses. With the exception of two cases (specimens 1 and 2) the proportion of ash never rises above 10 per cent. The exceptions are two French cakes: but even here the increase of mineral matter is not due to sand, but to the *real ash* of some other vegetable substance than linseed. Of the 22 per cent. of mineral matter in these specimens, more than one-half was carbonate of lime, of which very little is found in the ash of cake in general. It was obviously the ash of some woody matter, and so far might be due to adulteration, but certainly not by sand. The greater number of the ashes are under 8 per cent.—a quantity which will presently be shown to be but little above the proper proportion, supposing the cake to be made from pure and perfectly clean seed. The following analyses of the ash of four of these cakes, made in this laboratory by Mr. Ward, will help to explain the point under discussion.*

TABLE 9.—Composition in 100 parts of the Ash of Linseed Cake:—

	American. Spec. 11.	American. Spec. 12.	Russian. Spec. 25.	Russian. Spec. 26.	Mean of 3 Specimens, Nos. 11, 12, & 26.
Per-centage of Ash .	5·76	5·67	8·67	6·21	5·88
Silica and Sand . .	9·08	12·86	39·10	14·41	12·12
Phosphoric Acid. .	33·43	28·02	25·52	34·91	32·12
Sulphuric Acid . .	2·38	5·29	1·43	1·63	3·10
Carbonic Acid . .	6·88	·64	·26	·19	·90
Lime	9·04	7·87	5·60	7·52	8·14
Magnesia . . .	15·33	15·27	9·35	15·43	15·34
Peroxide of Iron . .	2·64	3·28	1·45	1·60	2·51
Potash	24·32	23·50	16·01	22·90	23·57
Soda	·93	·51	·43	1·01	·82
Chloride of Potassium	—	—	—	—	—
Chloride of Sodium .	1·06	1·87	·85	·42	1·12
	100·09	99·11	100·00	100·02	99·74

In taking the mean composition of the ash of linseed-cake, the specimen in the third column has been omitted from the high per-centage of sand which it contains. The other specimens afford a mean per-centage of 5·88 of ash, of which 12·12 is sand

---

* These per-centages of ash will all be a little *above* the mark from imperfect burning. Specimens 11, 12, 25, and 26, give the true ash, the charcoal, being weighed in the analysis and deducted. The average quantity of sand and charcoal in these ashes was determined upon the mixed ash of 25 specimens, which gave 9·54 per cent. of charcoal, and 22·32 per cent. of sand: consequently the ash determinations are 10 per cent. too high, except in the 4 specimens just mentioned.

in other words, 100 parts of cake contain less than one part of sand, whilst even specimens 25, which has an outside per-centage of ash, two-fifths of which consist of sand, will only contain 3½ grains of sand in every 100 grains of cake. So far, then, as the 33 analyses here recorded of specimens taken indiscriminately may enable us to judge, we are justified in stating that *sand* is not employed, or not *often* employed, to adulterate linseed-cake. Other remarks occur to us in examining the last table, but they will be better deferred.

Since, then, mineral adulteration is not practised, Is any vegetable substance ever mixed with the cake, having the effect of altering the per-centage of nitrogen to the extent we have seen? This question rightly belongs to the microscopical observer. It is possible that such may be the case; but the low per-centage of ash, together with the general absence of carbonates in it, forbids the notion that any large proportion of woody matters, such as sawdust, &c., should be used to adulterate the cake. And, independently of this negative evidence, it can be shown that the composition of the seed sufficiently accounts for all differences in that of the cake. To this point I therefore at once pass.

Linseed.

The following analyses of linseed will serve to show to what variations the seed is liable, although their number is insufficient to afford very satisfactory averages of its composition.

Circumstances did not allow of the extension of this part of the inquiry; but as the analyses are sufficient for the present purpose, I regret it the less that another opportunity of publishing a larger number of these results will no doubt occur, when the question can be entertained at greater length.

The first specimens to be described are foreign linseeds: they were obtained from an intelligent merchant and manufacturer, who is practically conversant with the whole subject.

No. 1 is average Riga, weighing 52½ lbs. to the bushel, and should produce from 90 to 95 lbs. of oil per quarter (22 per cent.).
No. 2, good Memel, 56 lbs. per bushel, should produce 100 to 105 lbs. of oil per quarter (22·8 per cent.).
No. 3, Black Sea, 53¼ lbs. per bushel, should produce about 112 lbs. of oil per quarter (26·3 per cent.).

All of these specimens were mixed with other seeds: these were carefully picked out, and their proportion ascertained.

No. 1, Riga, contained of other seeds (principally cabbage, turnip, and rape) 9·30 per cent.
No. 2, Memel, 10·34 per cent.
No. 3, Black Sea, 7·56 per cent.

We do not possess any analyses of these seeds (with the exception of rape), and cannot therefore judge what would be their effect on the composition of the cake. They are, however, all of the description which we know to be rich in nitrogen as well as oil; and although they might injure the flavour, it is not probable that they would much diminish the albuminous principles of the cake which should be made from the linseed containing them. It is to be observed, however, that the analyses which follow were made upon the *pure linseed itself*, after the separation of the other seeds, and no peculiarity of composition is therefore to be referred to their presence.

TABLE 9.—Analysis of Specimens of Foreign Linseed :—

	NITROGEN.			Oil.	Water.	Ash.
	1st Analysis.	2nd Analysis.	Mean.			
No. 1. Riga Linseed .	3·57	3·64	3 60	34·70	9·45	5·25
No. 2. Memel Linseed	3·31	3·36	3·33	36·00	8·74	3·56
No. 3. Black Sea Linseed	3·36	3·27	3·31	38·42	10·12	5·64

The mean of these specimens is :—

Nitrogen	3·41
Oil	36·37
Water	9·44
Ash*	4·78

The next table gives the composition of four specimens of home-grown seed, the first having been grown by Mr. Warnes, the second by H.R.H. Prince Albert, and the other specimens obtained from Messrs. Gibbs, of Half-Moon Street. These samples were all free from dirt or other seeds.

TABLE 10.—Analyses of Specimens of English Linseed :—

	NITROGEN.			Oil.	Water.	Ash.
	1st Analysis.	2nd Analysis.	Mean.			
No. 4. Grown by Mr. Warnes, 1847 .	4·54	4·66	4·60	36·66	12·33	2·68
No. 5. Grown by his H. R. H. Prince Albert, 1847 . .	4·24	4·32	4·28	32·77	11·00	3·30
No. 6. Growth of 1847, Messrs. Gibbs .	4·21	4·29	4·25	33·50	10·58	4·08
No. 7. Growth of 1848, Messrs. Gibbs .	4·22	4·37	4·29	38·11	8·57	4·03

---

* For the reasons given in the analysis of the cake, I believe the stated per-centage of ash to be somewhat over the truth.

The mean being—

Nitrogen	4·35
Oil	34·76
Water	10·62
Ash	3·52

Comparing the results in the table with those of foreign linseed, we find that great differences occur in the proportion of albuminous matters. No. 3 contains only 3·31; No. 4, 4·60 per cent. of nitrogen—which numbers are equivalent to 21·0 and 29·2 per cent. of albuminous principles respectively. It is not my intention to assert that foreign linseed is uniformly or generally less rich in nitrogenous substances than home-grown seed: the number of specimens examined does not warrant such a conclusion, and for the present, whatever may be the result of a further examination, the question must be left open. But the facts do appear to justify us in believing that the seed itself, even when free from the admixture of other seeds and from dirt, is subject to great variation in composition. Neither in the present case is the low per-centage of nitrogen to be referred to an inferior or imperfectly ripened seed, since No. 2 is called by a competent judge "good Memel,"* and has a high weight per bushel (56 lbs.). Whether the variation in albuminous constituents is to be attributed to climate or any other circumstance is not the question at present, but simply whether the difference in the seed is sufficient to account for the difference in the cake. The quantity of oil yielded on the large scale by samples of linseed varies considerably. Average Riga, for instance, will yield about 20 per cent. of its weight, whilst Bombay seed affords as much as 26 per cent.

For the convenience of calculation, let us suppose that two samples of seed, the one containing 3·31, the other 4·54 per cent. of nitrogen, lose upon pressure 20 per cent. of oil each. As the whole of the nitrogen remains in the cake, whilst the latter is diminished in weight by one-fifth, the per-centage of nitrogen in the resulting cake will be one-fourth † more than the above numbers. Consequently the two samples instanced would afford cakes containing 4·14 and 5·67 per cent. of nitrogen respectively, which numbers represent, within a very little, the amount of variation actually observed between different samples of linseed-cake.

No doubt, had a larger number of samples of linseed been examined, the limits of variation might have been extended; but the instances now adduced amply prove that differences

---

* In the eyes of a linseed crusher a seed would probably be "good" which would give a large yield of oil.

† Thus 80 of cake will contain the same nitrogen as 100 of seed—then

	Cake.		Nitrogen.		Cake.		Nitrogen.
As	80	:	3·31	: :	100	:	4·14

which is therefore the per-centage.

occur in the composition of the *seed* adequate to account for similar differences in the composition of the cake. Thus an answer is afforded to the third question proposed, and indirect evidence supplied in the negative to the question of adulteration.

That this subject may be as complete as possible, I insert here the mean of two ash analyses of linseed.

TABLE 11.—Mean Composition of the Ash of Linseed :—

Silica	1·45
Phosphoric Acid . . .	38·54
Sulphuric Acid . . .	1.56
Carbonic Acid . . .	·22
Lime	8·40
Magnesia	13·11
Peroxide of Iron . . .	·50
Potash	34·17
Soda	1·69
Chloride of Potassium . .	• •
Chloride of Sodium . .	·36
	100·00

The composition of the ash of linseed, and that of linseed-cake, should exhibit no other difference than that produced by the accidental introduction into the latter of a little sand and dirt, as well as of some portion of the substance of the stones used in grinding the seed. Accordingly we find that, making allowance for this circumstance, the per-centage composition of the ash of the cake approaches very nearly what would be expected.* In *quantity* of ash, the cake of course exceeds the linseed in proportion to the oil expressed. Where the per-centage of ash in the cake is high, it is mostly due to its containing more sand, as in the case of specimen 25, which is given in the table at p. 484. We may conclude this subject by recapitulating the conclusions to which we have been led :—

1. That samples of cake differ considerably both in the proportion of albuminous matter and of oil contained in them.
2. That in respect to the former (the albuminous matter) there would appear to be no general distinction between home-made † or foreign cakes.
3. That in the proportion of oil there is reason to believe a general distinction does exist, more especially between English and French cakes, and in favour of the former.

---

* Except in the potash—some of which seems to have been lost—for whilst in the ash of the seed it stands to the phosphoric acid in the relation of 34 to 38½, in the cake it is as 23½ to 32, which is a very different proportion. Is potash expressed from the seed in the form of soap dissolved by the great excess of oil?

† I say "home-made." This term merely implies that the seed was *pressed* at home —there being no evidence to show that the seed in any of the English cakes described was other than Foreign seed.

4. That there is no reason to believe that linseed-cake is adulterated at any time with sand or other earthy matter —adulteration by other matters being also rendered unlikely, by the next fact, namely,
5. That different samples of seed, free from admixture of other seeds, or from impurity of any kind, present variations in the proportion of albuminous matter amply sufficient to account for those found in specimens of cake.

But whether the differences in chemical composition of the cake are such as to account for observed differences in feeding properties, it is left with the reader to decide.

Of the relative price of different samples of cake I have nothing to say. Under the most favourable circumstances for comparison, it would be difficult to fix upon any starting-point, where the price is so fluctuating. Some of the samples described were sold at 9*l.* 10*s.*, others as low as 6*l.* per ton. The only general relation at all perceptible between price and composition is in the fact before mentioned, that the English-pressed cakes, which are richest in oil, also bear a very generally high price in the market. That this is no rule, however, the higher price of French than American cake, coupled with a smaller per-centage of oil, sufficiently proves.

Rape-Cake.

Two analyses of this cake, and one of rape-seed, are given below. Of their history I am unable to speak.

Analyses of Rape-Cake :—

	NITROGEN.			Oil.	Water.	Ash.
	1st Analysis.	2nd Analysis.	Mean.			
No. 1. —— . . .	5·29	5·17	5·23	11·63	7·06	5·70
No. 2. —— . . .	5·62	5·54	5·58	10·62	6·62	10·41

All that can be said from the above analyses of the composition of rape-cake is, that it is very much the same with that of linseed-cake. Till lately, however, the hot flavour of rape-cake has been an insurmountable objection to it as a substitute for the more costly article.*

Rape-cake has been more often employed as manure. The following analyses of its ash, made for me by Mr. Eggar, will not therefore be without interest :—

---

* See Mr. Pusey's notice on this subject in the July Journal, 1849.

TABLE 12.—Composition in 100 parts of the Ash of Rape-Cake (Spec. 1) :—

Sand and Silica	13·07
Phosphoric Acid	32·70
Carbonic Acid	2·15
Sulphuric Acid	1·62
Lime	8 62
Magnesia	14·75
Oxide of Iron	4·50
Potash	21·90
Soda	—
Chloride of Potassium	·17
Chloride of Sodium	·46
	100·00

The ash of rape-cake is therefore in every respect the counterpart to that of linseed-cake. A ton of the cake will contain 128 lbs. of mineral matters, one-third of which is phosphoric acid, one-fifth potash, and one-seventh magnesia. Even although, as in the second specimen, the total quantity of ash should be greater, the above numbers will hold good, the excess being sand. Only one specimen of rape-seed has been examined: it was the seed of dwarf-rape, and obtained from Messrs. Gibbs.

Analysis of Rape-Seed :—

	NITROGEN.			Oil.	Water.	Ash.
	1st Analysis.	2nd Analysis.	Mean.			
	4·17	4·26	4·21	37·84	6·44	3·31

Beans and Peas.

The want of certain data as to the composition of even the commonest agricultural produce is constantly felt by all those who are engaged in investigating the principles of agriculture, and every trustworthy analysis will therefore be welcomed as an addition to our stock of knowledge. Such analyses, though they may serve no immediate purpose, must greatly smooth the way for those experimenters who, having chalked out for themselves a path of inquiry sufficiently arduous in itself, are anxious to deviate as little as possible into secondary or collateral subjects of research.

As a contribution to the *scientific statistics* of agriculture, I offer a few analyses of peas and beans, which will serve to show the average composition of these grains, so far as the albuminous principles and fatty matters are concerned.

The specimens were those of which the ash analysis is given in a former number of this Journal (vol. ix. part 1); and although

I do not propose to offer any remarks upon their composition in relation to the soil on which they were grown, it may not be amiss so far to record the history of each. The nitrogen analyses were made for me by Mr. Ward; the estimations of oil principally by Mr. Eggar.

TABLE 13.—Analyses of Peas:—

	NITROGEN.*		OIL.		Water.
	On the Undried.	On the Dry Matter.	On the Undried.	On the Dry.	
No. 1. White Peas (Seed) . .	3·98	4·61	Not	estimated	13·60
No. 2. Ditto (Produce on Clay) .	3·57	4·22	1·01	1·19	15·40
No. 3. Ditto (Produce on Sand) .	2·97	3·44	Not	estimated	13·60
No. 4. Maple or Grey Pea (Seed)	3·08	3·67	1·56	1·83	14·60
No. 5. Ditto (Produce on Clay) .	3·47	4·16	1·54	1·85	16·60
No. 6. Ditto (Produce on Sand) .	3·28	3·92	1·04	1·24	16·40

The *mean* result of the foregoing analyses is as follows:—

	Undried.		Dry.	
Nitrogen in White Pea . .	3·51	Mean of 6	4·09	Mean of 6
Nitrogen in Grey Pea . .	3·28	3·40	3·92	4·00
Oil, Mean of 1 White and 3 Grey	1·29		1·53	

TABLE 14.—Analyses of Beans:—

	NITROGEN.		OIL.		Water.
	On the Undried.	On the Dry Matter.	On the Undried.	On the Dry.	
Heligoland or Tick Beans (Seed)	3·57	4·11	1·15	1·29	13·20
Ditto (Produce on Clay) . .	2·81	3·27	1·25	1·45	14·20
Ditto (Produce on Sand) . . .	3·40	4·04	1·53	1·82	15·80
Mazagan Bean (Seed)	2·36	3·74	1·47	1·69	17·00
Ditto (Produce on Clay) . . .	3·19	3·59	—	—	11·00
Ditto (Produce on Sand) . . .	3·49	4·18	1·71	2·05	16·50

Mean Composition—

	Undried.		Dry.	
Nitrogen in Heligoland Beans .	3·26	Mean of 6	3·81	Mean of 6
Nitrogen in Mazagan Beans .	3·01	3·13	3·84	3·82
Oil in Heligoland Beans .	1·31	Mean of 5	1·52	Mean of 5
Oil in Mazagan Beans . .	1·59	1·45	1·87	1·79

Of these analyses, I would merely say that they show a very close resemblance between beans and peas in the proportion of albuminous matter, although it is at the same time obvious that

---

* A second analysis for nitrogen was not made in all cases; the following, however, may be mentioned:—

	1st Analysis.	2nd Analysis.	Mean.
No. 1.	4·64	4·58	4·61
No. 4.	3·62	3·72	3·67
No. 5.	4·20	4·12	4·16

their composition is liable to very considerable variation. Neither in the peas nor beans does the average composition appear to fluctuate with the variety, but to rise or fall in obedience to laws which the analyses are not intended to elucidate.

Note by Mr. Pusey.

I am glad to be able to report favourably as to the discovery accidentally made by me (as mentioned in the last number), that sheep, when at turnips, can be fed on rape-cake without the admixture of linseed-cake. This autumn I have kept 700 fatting sheep in this way, on rape-cake, with entire success; and in order to be certain that the progress in condition was equal, I put up two little lots of ten sheep each, keeping one upon rape-cake and the other on linseed-cake. Not the slightest difference could be perceived between the two lots. As the best linseed-cake costs 7*l.* 10*s.*, and the best rape-cake only 4*l.* 10*s.* per ton, the saving in the production of mutton, arising from the use of rape-cake, is really considerable. In that of beef it is not so much, as I do not find that my beasts like a larger proportion of rape-cake to linseed-cake than pound for pound of each.

XXV.—*On the Advantage of Deep Drainage.* From the Right Hon. C. Arbuthnot.

To the Secretary.

Walmer Castle, October 9, 1848.

My dear Sir—No consideration could induce me at any time to engage in litigious controversy upon any subject whatever, and much more unwilling should I be upon the question, whether it be the more advisable to have deep drains or shallow ones.

If, therefore, I feel inclined to make some observations upon the subject of drainage, I can assure Mr. Bullock Webster, whose article I have read in the Royal Agricultural Journal of August last, that, to use his own words, I am neither of the deep nor of the shallow *faction;* but that I will confine myself to stating what has been my own experience, and what that of friends to whom I had communicated the result of my practice.

I had happened some years ago to read an article in the Royal Agricultural Journal on deep drainage by Mr. Josiah Parkes, and it struck me to be so reasonable that I resolved to try the plan upon some very stiff clay on the farm I cultivate in Northamptonshire. I wrote to my bailiff, Mr. Andrew Thompson, to drain a small field of seven acres, and to put the drains at the depth of 4 feet, and at wide intervals between the drains. This was effected as I had desired. My bailiff, being a very intelligent and unprejudiced man, made no objection, but he only doubted much whether the very wet and most tenacious clay which I had selected could be rendered dry by drains at wide intervals and 4 feet deep.

The field in question, at the time of trying the experiment, was old grass-land, which, previous to the deep draining, was pared and burnt; and being in high ridges of various widths, it was necessary to place the deep drains at intervals of unequal width. The width of the intervals was 40 feet upon an average.

My experiment succeeded so completely that I was then anxious to communicate with Mr. Parkes, but I neither knew him nor where he resided. You may perhaps remember that I sent to you the letter which I had written to him, desiring that you would be so obliging as to forward it.

Since that first experiment I have drained a considerable part of my cold clay land on the same principle, and invariably with the same success. It would, therefore, be quite unnecessary to enter into further details as to my own practice; but, nevertheless, I must be allowed to notice one particular field which has been subjected by me to the deep-drainage system. This was a field rather varied at top, but chiefly of strong clay; and the subsoil in particular is so tough, and so difficult to work, that doubts were entertained as to the practicability of laying the land dry by means of drains sunk so deep as 4 feet from the surface. The work, however, was perfectly well executed; and the question then was, what should be the first crop on this deep-drained field. My bailiff, who had become a perfect convert to deep drains at wide intervals, resolved to sow it with turnips. The farmers of the neighbourhood said that such strong clay land was not calculated for turnips. They, however, turned out the best that I saw that year; and my bailiff, having gone in the autumn to see his father in Roxburghshire, declared to me on his return that he had seen no crop superior to it in Scotland. More than this, it had happened that Lord Lilford, living not many miles from me in Northamptonshire, saw that particular field while under the process of draining. He was struck with the very bad appearance of the soil, consisting, as I have said, of very strong clay above and below; and his lordship was again at my place when the field was covered with a magnificent crop of turnips. His astonishment was the greater, from seeing upon that field of strong clay a flock of sheep, which remained there without the slightest injury to the land during the winter till all the turnips were consumed.

Having satisfied my own mind that deep-draining is advisable, I naturally stated the result of my proceedings to those of my friends whose lands required draining. I will mention some of those friends with whom I communicated upon the subject, selecting those whom I knew to be possessors of very strong clay-land. I advised the Duke of Wellington, the Duke of Bedford, Sir Francis Lawley, and Sir Robert Peel, to try the system which had so entirely succeeded with me. I have seen land belonging to the Duke of Wellington, at Stratfieldsaye, so drained, and upon tenacious clay, as I know by the analysis of it; and with him it has had such good effect that his land-steward is intending by degrees to have the whole of the Duke's estates in Hampshire drained to a great depth; never at a less depth than 4 feet, but in some instances, according to the nature of the soil, at a still greater depth.

I have seen also the beneficial effects of deep drainage at Drayton Manor, the seat of Sir Robert Peel, in Staffordshire. Some of Sir Robert's land in that county is strong, and some of it inclining to sand. On all of his land, that which is clayey and that which is sandy, the deep drains have been efficacious; taking care, of course, to drain at greater and at lesser depths, and at wider or closer intervals, according to the nature of the soil; but never, I believe, on land in his own occupation, putting in a drain at less than 4 feet deep.

I have not seen Sir Francis Lawley's land. He has, however, told me that he considers deep drainage, upon his very strong clays in Shropshire, the greatest improvement that he had ever practised himself, and, in his belief, the greatest that had ever been introduced into the agriculture of this country.

I have reserved for the last what I have to say respecting the practice of the Duke of Bedford.

I wrote to the Duke soon after I had read the article by Mr. Bullock Webster, and I requested him to let me see again a letter which last spring he had received from Mr. Bennett, his principal steward at Woburn.

I have no doubt erroneously, but certainly I had imagined that Mr. Bennett, when some few years ago I wrote to the Duke of Bedford upon this subject, was adverse to deep-drainage upon the very strong Bedfordshire clays, termed there "gault," I think; stating, as I thought, I recollected that it would be impossible for rain to percolate through their tenacious subsoils. Whether I was mistaken or not respecting Mr. Bennett's first opinion, it was highly satisfactory to me to read a letter of his to the Duke of Bedford, in which he mentioned that after the heavy rains of last spring he had found the deep-drained land made sounder to ride upon than the land which had been shallow-drained. It was the more satisfactory, as I knew that Mr. Bennett was a very sensible, and, in agriculture, a very practical gentleman.

On the 4th of the present month (October) the Duke of Bedford wrote to me as follows:—

"I have not been able to find the Report you asked for about draining, but I spoke to my steward, Mr. Bennett, on the subject the other day, and I have since received from him the enclosed letter. These last rains have caused great floods in Beds and Northamptonshire. Mr. Bennett has looked at several of the drains since, and finds his deep ones again acting best. Return his letter, but take a copy of it if you please."

Thus writes the Duke of Bedford, and towards the end of his letter he reverts again to the subject of draining. He says:—

"I went in August to Castle Howard, where I saw a field that had been drained. Half by ——— shallow; the other half by Mr. Parkes deep. The advantages of the latter were very great, both as to *cost* and *effect*."

Having quoted parts of the Duke of Bedford's letter, I will now give a copy of Mr. Bennett's letter to his Grace, which I have been allowed to make use of as I please. The following is Mr. Bennett's letter:—

"*Park Farm Office*, 3rd *Oct.* 1848.

"My Lord Duke,

"In reference to the question your Grace asked me about draining, I beg to inform you that when the work was first begun in the park the drains were put in 30 inches deep and 1 pole apart. They have gradually been increased in depth and distance apart up to 4½ feet, and in some instances 5 feet deep, and 11 yards and in some cases more apart. After last spring, which was the longest continued wet we had experienced since the work was done, I found the deepest drained land was the soundest and the driest to ride over. I do not know whether I may be classed as a convert to deep draining or not, for I always was of opinion the nature of the subsoil ought to regulate the depths of draining, and that one uniform depth would not suit all places alike.

"I find the 11 yards apart is on strong clay land as great a distance as can be depended on, but I have some at 15 yards which answers exceedingly well, the subsoil being more porous.

"I have the honour to be
"Your Grace's most obedient servant,
"Thomas Bennett.

"To his Grace the Duke of Bedford."

After what I have written, and after what I have heard from others, it will not I think surprise any one that I should be an advocate for deep drainage. The gentlemen who have given a different opinion to Mr. B. Webster must know best what they think is suitable to the land they occupy. I say nothing against their expressed opinion, except only that in more instances than one I have observed that the land drained by them was a *flat*, from which, without an adequate fall, or without methods attainable for the purpose, it would not be possible for deep drains to emit the water contained in them. I have given some of the many instances in which deep draining has been found far superior to the shallow mode. I am satisfied with the result, and my hope is that the system of draining deep will in time be generally adopted.

Mr. Webster says that the deep-drainage system is pretended to be a new one; I believe that it has been newly reproduced, and by the science and good sense of Mr. Parkes; but that the system is not new, and only revived, may be proved by a book written in the time of Oliver Cromwell, and called 'Blyth's Improver Improved;' and still more anciently was the system practised in our country by the Romans, as was discovered by excavations to have been the case some few years ago, when a regular system of deep drains at wide intervals was found to have been the practice when the Romans had possession of the greatest part of Britain.

I should be exceedingly sorry if I had said a word which Mr. B. Webster could think offensive. It would appear to me as absurd to belong to a "faction" for deep or shallow draining as we all think it laughable in 'Gulliver's Travels' that there should be in Lilliput a deadly feud between Big and Little-endians. I have sought to establish what I believe to be the truth; but I do not say a word against Mr. B. Webster's practice nor against that of the friends he has quoted. I make no comment on the practice of others; I merely state what I have witnessed myself and what I learn from my friends.

There is indeed one additional observation which I ought not to omit. My first experiment in deep-draining was, as I have already mentioned, on a field of 7 acres. That small field was separated only by a hedge from a much larger field, which had previously been drained according to the shallow system by drains 30 inches deep and at intervals of 18 feet. Nothing could be better executed than the drains in that field; and the soil and subsoil (as I knew by analysis) were precisely similar to those in the adjoining field which had been drained 4 feet deep and at very wide intervals. I happened to be at home soon after the fall of very heavy rains. I myself saw the deep drains begin to pour out water from their main drain before the same occurred in the shallow-drained field; and subsequently I saw that the shallow drains ceased running long before the deep ones.

I felt that it was due to Mr. Parkes, and due also to the farming world in general, that I should make known what has been my practice, with its results, and what also has been that of some of my friends.

We need not be alarmed by the apprehensions intimated by Mr. B. Webster. He fears that deep drains, though efficient at first and for a time, will become inoperative after a lapse of years. Some have doubted whether rain could ever force its way through very strong clay; but, when channels have been made, every succeeding shower must tend more and more to keep those channels open and also to cause new ones. In this way deep draining may to a certain extent produce the effect of subsoiling; for deep-drained land becomes annually more porous and more accessible to the roots of plants.

I am, dear sir, very faithfully yours,

CHARLES ARBUTHNOT.

To James Hudson, Esq.

Below Mr. Webster's article a note is added by Mr. Pusey. With him I have not the honour to be acquainted, but I know his character sufficiently to respect him greatly. I have understood that Mr. Pusey had never himself practised deep draining; and indeed his note leads me to believe that he was, as he had done before, merely advising caution in draining, and that his observations have not been on drains of his own land. If in this I am correct, he could not have so well known whether the drained land shown to him was underneath and out of sight properly or ill executed.

CH. A.

P.S.—Since writing the above I have had a letter from Mr. Bennett, in which he says that the shallow drains at Woburn were not by his advice, but upon the recommendation of a person thought an authority in such matters. It will have been seen by the letter above quoted to the Duke of Bedford that the shallow drains were superseded as inefficacious, and, being replaced by deep ones, the land had become drier and sounder to ride upon. Mr. Bennett also states in his letter to me that last year he had put in drains at 11, 15, and 22 yards apart, and at 4, 4½, and 5 feet deep in the same field, and that after the rains of last month there was no perceptible difference, all having been equally efficacious. The subsoil in that field, he says, is a very strong clay, interspersed with small veins of sandy loam and gravel, which of course act as so many arteries and feeders to the pipes.

Thus writes Mr. Bennett, and nothing can be more valuable and conclusive than his testimony in favour of deep drains at wide intervals.

It would have been unjust to Mr. Bennett if I had not let it be known that he had not been the adviser of shallow drains at Woburn.

CH. A.

Note.—The above letter to Mr. Hudson was written, as the date will show, in October of last year. I sent it too late for the next publication of the Journal. Other circumstances prevented its appearance in the Journal of July last; but this delay has enabled me to add an additional proof of the superior advantage arising from deep drainage. On the 5th of this month of August the Earl of Ellesmere wrote to me from Lancashire, that "he was busy organising further drainage, and that he shall have enough to do in that way for the rest of his life. He had been obliged," he says, "to redrain land which remained wet after *a 3-feet drainage*, and to insert *4-feet drains*."

I know from Lord Ellesmere himself that he had on the chat moss gone from necessity so deep as 10 feet before he put in his drains, and that the part of the moss so drained had been rendered quite dry.

August 7, 1849. CHARLES ARBUTHNOT.

Note by Mr. Pusey.

There can be no doubt that agriculture is much indebted to Mr. Parkes for the talent with which he has pointed out the advantage of deep-draining upon the majority of soils. The only question is, whether it be applicable to all soils without exception. Mr. B. Webster, in the paper referred to, brought forward cases in which farmers, having laid down deep drains in tenacious clays, had taken them up, and replaced them with shallower drains at their own expense. It still appears to me, therefore, that caution is required in employing very deep drains on very tenacious clays, and that Lord Portman * is right in saying,—

> "I am more and more convinced, by experiment and observation, that no rule can be safely fixed for the depths and distances of drains. I think that in each case it would be wise to make experiments prior to the engaging in any large work of draining, having regard to the strata of the earth, as well as the sources of the supply of water."

Quite recently two careful but contradictory experiments have been made in Scotland on this very subject. They are here subjoined from the Mark-Lane Express. The first tells in favour of *deep* draining :—

"At the last monthly general meeting of the East of Berwickshire Farmers' Club, D. Milne, Esq., of Milnegraden, the president of that very efficient club, read the following report of experiments he had recently made on the above subject :—

"Mr. Milne stated that, having to drain a 24-acre field, he took the opportunity of trying the effect of drains varying in depth and distance. He divided the field into four parallel breaks—each about 6 acres in extent. In the westernmost the drains were 3½ feet deep and 30 feet apart; in the one next to it the drains were 3 feet deep and 15 feet apart; in the third the drains were 3½ feet deep and 15 feet apart; in the fourth they were 3 feet deep and 30 feet apart. The furrow-drains in each break led into a

---

* Roy. Agric. Journ., No. XXII. p. 452.

large drain at the ends; and at the mouth of each large drain a water-meter was placed. The field was drained in the winter of 1847-48. It had been 14 years in grass. Its last crop (viz. in 1834) was wheat, of which the land produced on an average 33 bushels per acre. In the spring of 1848 the field was partly sown with sandy oats, and partly with black oats got from Essex. The water-meters were set in June, 1848, and were removed in April, 1849. At harvest of 1848 the stooks were counted, and the following was the result:—

Sandy Oats.

On 3 feet and 15 feet drains, 558½ stooks per acre.
,, 3 ,, 30 ,, 503¼ ,,

Black Oats.

On 3 feet and 15 feet drains, 562½ ,,
,, 3½ ,, 30 ,, 542¾ ,,

These crops, on being thrashed, yielded as follows:—

Sandy Oats.

On 3 feet and 15 feet drains, 44 bushels per acre.
,, 3½ ,, 30 ,, 63⅜ ,,
Weight—41 lbs. per bushel.

Black Oats.

On 3 feet and 15 feet drains, 52⅜ ,,
,, 3½ ,, 30 ,, 74⅜ ,,
Weight—40 lbs. per bushel.

Some modification of these results was, however, necessary, in regard to the black oats, in consequence of one of the breaks on which it grew having been on nearly one-half of it shaded by trees. That the trees had the effect of considerably lessening the produce, particularly of grain, is evident from the following statement:—

Black Oats.

Break shaded, produced 611 stooks per acre.
,, unshaded ,, 514½ ,,
,, shaded ,, 70⅝ ,,
,, unshaded ,, 34⅝ ,,

If the shaded break is thrown out of view, the result, as regards black oats, would be as follows:—

On 3 ft. and 15ft. drains, 611 stooks per acre.
3½ and 30 ,, 542¾ ,,
3 and 15 ,, 70⅝ bushels ,,
3⅛ and 30 ,, 75⅜ ,,

The quantity of seed sown for both kinds of oats was at the rate of five bushels per acre. The water discharged from the two sets of drains was as follows:—

From the 3 ft. and 15 ft. drains, 35,711 gals. per acre.
,, 3½ and 30 ,, 46,510 ,,

In this calculation the quantity of water which fell on the few acres shaded with trees was thrown out of view. From these results it would appear that rather more water had been discharged by the 3½ drains than by the 3-feet drains, though the latter were twice as numerous as the former. In those parts of the field therefore drained by the 3-feet drains there was more water left in the land, or went off by evaporation; and there was also less depth of soil for the roots. This fact seemed to explain the produce obtained. If the number of stooks afforded a correct criterion of the quantity of straw, there was most straw on the 3-feet drains, and most grain on the 3½-feet drains; from which he would infer that a damp soil, though favourable to large produce in straw, was unfavourable to large produce in corn. The 3½-feet drains probably produced with greater dryness greater warmth, as the larger quantity of rain which they carried off would impart to the soil a greater amount of heat. Why the 3½ drains, though one-half as numerous as the 3-feet drains, should carry off as large or a larger quantity of water, was a separate question. Of course the deeper drains would draw from a greater extent of surface; but he had not anticipated that a 3½-feet drain would have drawn off double, or rather more than double, the quantity of water that a 3-feet drain draws. The water-meters, however, showed that this had been the case, unless indeed there were springs in those breaks where the deeper drains were. He was not aware that any such springs existed. The subsoil was pretty uniformly retentive throughout the field; and the upper soil was not perceptibly more open in one part than in another. So far, therefore, as his experiments had proceeded, they showed that if drains were made 3½ feet deep, only one-half the number will produce the same or a little better effect than 3-feet drains. The expense per acre of the former, in the field referred to, had been 4*l.* 6*s.* 4*d.*; of the latter 8*l.* 12*s.* 4½*d.* Mr. Milne stated that he had heard of a similar experiment having been tried in East Lothian by Mr. Hope of Fenton, with an opposite result. He had seen no account of Mr. Hope's experiment; but if correctly reported to him it would lessen his confidence in the results obtained by himself, and would be an additional inducement to persevere with his observations, in order to obtain further data for coming to a right conclusion. Probably, in another year, more correct data could be obtained, as in a few months only after the drains were made the soil could not have been opened very thoroughly. He had last winter put the subsoil plough through the field, and he would endeavour to ascertain what was the produce of this year's crop on the several divisions, and report the result to the club. One thing was quite evident, that with almost any system of drainage the increased produce amply compensated the cost. From the crop which had been yielded on the field above referred to, even after only six months had elapsed from the execution of the drains, he calculated that an increase of about 20 bushels of oats (equal to about 2*l.*) per acre had been obtained. This result was in conformity with what had been obtained from other fields previously drained by him. But on the general benefits of draining it was unnecessary to dwell. The great question now was, What is the system of drainage which could be done most efficiently, and at the least expense? To this point inquiries ought to be specially directed."

Mr. Hope's experiment, alluded to by Mr. Milne, is favourable to *shallow* draining, as the following account shows :—

To the Editor of the North British Agriculturist.

"Sir,—In reply to your inquiry as to the result of the experiments made by me, in draining with tiles at different depths and distances, I may premise that the field operated on may be described as rather a free loam, but upon a very stiff retentive clayey subsoil, mixed with small stones, quite free from under-water. The ridges were 18 feet in width, and were gathered up from the stubble, leaving every furrow open, to save spade labour. Into eight contiguous furrows, each upwards of 330 yards in length, there was put a drain of 3 feet in depth below the plough furrow. Then one furrow was missed, but in the following another drain of the same dimension was put. After that followed two furrows without any drain, thus leaving a ridge which may be said to be undrained. The rest of the field was done with drains 1 foot 8 inches in depth below the plough furrow. The land since then having been ploughed flat, the drains may be considered as 10 or 12 inches deeper than the depths cut with the spade. The cost of the 3-feet drains was 6*d.* per rood, or 4*l.* per S. acre; the ebb drains, 2¼*d.* per rood, or 1*l.* 10*s.* per statute acre.

"The draining of the whole field, which contains 15 S. acres, was finished early in February, 1841, and in summer was sown with turnips, the drills running across the drains or ridges. One half was made white globe, the other half Swedish turnip, the manure applied being half a ton of rapedust and 12 carts of farmyard dung to each variety per acre. The crop was removed and weighed on the 14th December, and the produce found as follows, per Scotch acre :—

	White Turnips.		Swedish Turnips.	
	tons.	cwt.	tons.	cwt.
On 3-feet drains, 18 feet apart	21	8	13	15
On 1 foot 8 inches ditto, 18 feet apart . .	24	6	13	17
On 3-feet drains, 36 feet apart	20	14	15	—
On portion undrained	21	8	10	15

"It was only after the white turnip had finished growing that the land could be said to be wet, and to receive any benefit from the draining. The subsoil, from the deep drains, appeared to be against the white turnips; but the Swedish were much larger where they came in contact with it. At the same time they were obviously thinner on the ground.

"About the middle of February, 1842, the field was sown with wheat, drilled across, that a like quantity of seed might be given to each part of it. Three bushels per acre was the quantity sown. The different portions were cut, stacked, and threshed separately; and the following is the result, per Scotch acre, the weight of all being the same, 62 lb. per bushel:

	Wheat.		Straw.		
	qrs.	bush.	tons.	cwt.	lbs.
On 3-feet drains, 18 feet apart	5	6¼	1	11	108
On 1 foot 8 inch drains, 18 feet apart . .	6	4	1	14	56
On 3-feet drains, 36 feet apart	6	0	1	9	84
On portion undrained	6	0	1	11	42

"From the period when the land was sown, until the crop was reaped, there never was more moisture in the soil than what was requisite for the growth of plants.

"The field was grazed in 1843 and 1844. Little or no difference was observed in the pasture during the first year, though, in the second, appearances were against the portion with deep drains. In the spring of 1845 the whole was ploughed up and sown with grey Angus oats. Before harvest the effects of the drains were very obvious, the crop on the ground ebb-drained being much heavier and bulkiest; at one period it was laid when the crop on the deep drains was all standing. On the latter, and on the ridge undrained, the crop was sooner ripe, though the field was all cut in one day. This accounts, in part, for the weight per bushel being greater on these portions; indeed, the quality improves as the quantity diminishes. The following table exhibits the result, per Scotch acre:—

	Oats.			Weight per bsh.	Straw.		
	qrs.	bsh.	pks.	lbs.	tons.	cwt.	lb.
On 3-feet drains, 18 feet apart . .	10	0	0	40	2	6	108
On 1 foot 8 inch drains, 18 feet apart	12	1	2	39	2	17	96
On 3-feet drains, 36 feet apart . .	9	4	2	40	2	4	26
On portion undrained	9	0	0	40½	2	4	40

On the removal of the crop there was a marked difference in the condition of the land, the deep-drained portion being full of couch grass, while the part with the ebb-drains was comparatively clean.

"In 1846 the field was sown with Skirving's purple-top yellow turnip, the manure applied being 5 cwt. of guano, 1 qr. of bone-dust, and 16 tons of farmyard manure, per Scotch acre. No difference was observable by the eye, the whole crop being fine. One-half of the crop was consumed on the ground with sheep, they being allowed at the same time 1 lb. of linseed cake each daily. While the sheep were on the ground it was found necessary to complete the drainage of the whole, every 18 feet, the water having stood from end to end of the field on the undrained furrows, for even the deep drains had little or no effect on the undrained furrow betwixt them. In 1847 the field was again in spring wheat (Fenton), and was a most magnificent crop throughout; it yielded, over the whole, 7 qrs. 6 bushels per Scotch acre, and weighed 63 lbs. per bushel. The field was pastured last year, and it kept but a small stock. It is now in oats, which, unfortunately, are a light, shabby crop, similar to most of the oats this season in the neighbourhood, and one part of the field cannot be said to be better than another. I have therefore no hesitation in giving it as my decided opinion, that on land with a stiff clay subsoil free from under-water, 30-inch drains are all that is required to carry off the surface water. All practical men are well aware that no general rule ever can be laid down for either the depth or the distance betwixt drains; this can only be determined by the nature of the soil and subsoil in each particular case. I have seen material benefit obtained from making drains 4 and 5 feet deep, when 2½-feet drains would have been money thrown away; but from the above and other experiments under like circumstances, I am also satisfied that to insist upon it as a rule to go deeper than 30 inches in all cases, the difference of the expense may be worse than money lost, that the crops may be materially hurt into the bargain.—I am, Sir, &c.,

Fenton Barns, Aug. 10, 1849. GEORGE HOPE.

XXVI.—*On Suiting the Depth of Drainage to the Circumstances of the Soil.* By J. H. Charnock, an Assistant-Commissioner under the Drainage Acts.

A Lecture before the Darlington Farmers' Club.

Looking with a present and prospective glance at the several circumstances and events which have to some extent aroused both the apprehension and the energy of the agricultural interest, and which are in all probability destined to exercise, for good or for ill, a still greater influence over that portion of the community, it may be affirmed that at no former period in the history of this kingdom did a more urgent necessity exist for a progressive advance in the science of agriculture, nor, happily, at the same time such an available amount of practical and scientific knowledge for furthering and securing so desirable an end. We have but to look back a comparatively few years and trace in our minds the several gradations by which we have arrived at the all but perfect adaptations of those discoveries and appliances which it has been reserved for our own era to complete, to realize their full influence. The day, for instance, was, and that within the recollection of most of us, when the application of gas in its present convenient form for illumination was considered at least of doubtful practicability, if not wholly chimerical; now, it is more common than the candles it eclipsed. Who does not also well remember the sceptical prognostications of the multitude, if not of the impossibility, at least of the very great improbability of steam power ever being beneficially applied to locomotion—and yet look at the result! See, too, the last crowning effort of man's research and application in the transmission of his embodied thoughts from one end of the land to the other in no longer time than is required for their utterance. And shall the cultivator of the soil, witnessing and experiencing the benefit of these achievements, remain stationary, when he, of all men, in matters pertaining to his vocation, has need of skill and observation?

That a considerable advance towards a higher, and therefore more profitable state of cultivation, has been made in many localities, is beyond doubt, and from the growing desire evinced on all hands for information on agricultural matters, it is equally manifest that this improvement will be extended; but, after all, how insignificant, unless as an earnest of more, is that which has been effected, when compared with what yet remains to be attained. Take, for example, an area of country with which you are probably more or less familiar, comprised for miles on either side of the line between Northallerton and Newcastle: now, with occasional exceptions, is not the general condition of this otherwise really fine corn-producing country, such as might be expected, were there neither hands nor appliances to be found to till it, nor mouths to be filled by its products, when in truth both are in excess? And yet by a judicious expenditure of about 4*l.* or 5*l.* per acre in an effective course of drainage the great proportion is capable of having its average yield of wheat increased by from 10 to 20 bushels per acre. What possible chance has the occupier of such undrained wet land of competing with his more fortunate neighbour on the naturally dry soils? Where the latter with two horses ploughs an acre or more a day, he has to use three or four horses for about one-half the same extent of work; and every other operation is subject to the same discouraging hindrances. He gets a scanty and precarious crop of wheat and weeds, yielding it may be 20 to 25 bushels per acre, whilst the other is comparatively certain, with less labour and anxiety, of 30 or even 40 bushels per acre. What, therefore, is 10*s.* or 20*s.* per acre additional rent for dry land, compared with the ruinous cost of cultivating these undrained soils? Not worth one moment's consideration; and the more so since at this day means and facilities for the execution of the work are within reach, on easy terms, of every owner. Some few years back a really valid and prudential reason did exist for the possessors of land having only a life interest, and being under other disabilities, not expending money in improvements which they might never enjoy. But these difficulties and prohibitions (for such they were in effect) are at length matters of history only; and any owner of entailed and settled estates, or tenant for life or lives, may improve his property by drainage, inclosure, building, &c., and his rent-roll at the same time, without any cost to himself, and with the greatest benefit to his tenantry. "What," the possessor of some long-neglected and water-logged property may exclaim, "do you seriously mean to tell me that without any greater interruption to my accustomed ease than the execution of a few forms and documents for the purpose, I can, at no absolute cost to myself, so improve this unfortunate property as to make it yield me a clear additional rental, and be the salvation of my half-ruined tenantry?" We do—and will endeavour to show how.

Within the area of the clay districts already alluded to it would not, in all probability, be difficult to find enclosed estates the average rental of which does not exceed from 10*s.* to 15*s.* per acre, and yet the occupiers barely able to live upon them. Now I dare say you know that, under the General Drainage Act (9 & 10 Vic., cap. 101), Government was authorized to advance the sum of two millions for the drainage of lands in England and Scotland, repayment being made by a rent-charge on the lands drained of 6½ per cent. per annum on the outlay, for 22 years, which paid both the principal and interest in that period. The whole of this sum has been long since applied for; and later applicants are left regretting their ill fortune. All this, I say, you probably know, and may think, with many others, that seeing the inconvenience of such grants in times of pressure, Parliament may be slow to vote any further sums for the purpose;* but you may not be aware of the powers and facilities which the legislature has given for obtaining the means from other sources on terms but little if at all inferior to those of the Government loan itself. Suppose then an owner of an estate of 500 acres of this wet land obtains 2500*l.*, or 5*l.* per acre, under the provisions of this Act,† the rent-charge on the land will be about 6*s.* 4*d.* per acre, which, with the original rent of 10*s.*, gives 16*s.* 4*d.* an acre as the rent of the land when effectively drained, but without adding any present profit for the owner. But I apprehend once let the occupiers of such land experience the benefit of cultivating it in the drained state, and they will infinitely prefer paying 20*s.* an acre, or more, to continuing in the old course; and thus both they and the owner will realize all they desire.

As respects the practical execution and effects of drainage, without wearying you by entering into minute details, there are yet some leading points which it may be well to notice. That there is *no one mode of drainage equally applicable and effective on all soils, may now be considered as a settled truth;* and hence it necessarily follows that a certain knowledge and experience must be exercised in conducting the work in such a manner upon each character of soil and subsoil as shall attain the most perfect result at the least cost. And what, you will naturally ask, is a *perfect* result? for assuredly without a definite perception of this there is little hope of its being attained. But, fortunately it is one of those essential points which is not dependent upon mere opinion for a practical settlement, because we have presented to us in all the naturally dry turnip and barley soils of the kingdom an example of suitable and effective dryness which no one can dispute or gainsay. The more nearly then by artificial drainage we make the mechanical condition of the clay soils approach this standard, the more nearly shall we secure that perfect state for cultivation which every scientific drainer ought to understand and aim at obtaining. There may be, and doubtless

---

* The Legislature have in the past Session passed an Act, entitled "*The Private Money Drainage Act*," giving the same facilities, and continuing the Inclosure Commissioners and their staff the medium for its operation, as was given under the general Act, the only difference being that the money is obtained from private sources instead of from the public purse.—*York, October*, 1849.

† The West of England Drainage Company's Act of Incorporation enables owners of a limited interest to make the charge *absolute* on the land, as well as for a limited period of 25 years; and the advantages thus afforded may be regarded by some as *exceeding* those given under the General Drainage Act.

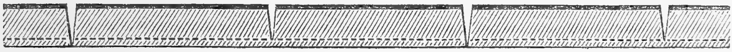
are, many whose scepticism and prejudicial love for the beaten track, be it ever so toilsome and slippery, will not admit of their crediting the practicability of the drainage of clay lands being rendered so thoroughly effective as these remarks indicate; but since we must feel, from past experience and the evidence of practical results in things of much more improbable accomplishment, how mistaken we were, I venture to think that none of those I am addressing will be found in that state of doubt.

Experience and observation have convinced me that in the drainage of *retentive* subsoils it is quite impossible to insure a proper uniformity of dryness over the entire surface if the drains are at *too great intervals.* Additional depth will not in these cases compensate for additional distance; and it must always be borne in mind that the safe side is the best, for nothing but a satisfactory result can attend the more frequent, whilst only a doubtful or protracted effect may follow the more distant; and in a season like the present practically render the work of little or no use. I know some land which in the autumn of 1847 was pretended to be drained in a masterly manner, with the drains 4½ feet deep and 60 feet apart, but the work being completed at too late a period to be sown with wheat, it was reserved for spring sowing: as ill-fortune, however, would have it, the spring of this year was so unpropitious that there never was a long-enough interval from rain to allow these drains to act so as to dry the land sufficiently to be worked; it consequently remained in fallow, and it may be questionable whether it is even yet sown. See therefore the serious loss to all parties from such a misapplication of deep and distant drains. For an instance of the proper application of deep drainage, we may refer, amongst numerous other examples, to that on the estate of Sir Samuel Crompton, at Wood End, near Thirsk, where one or two independent drains of from 7 to 10 feet deep, are laying perfectly dry a very large area of land on either side of them. The subsoil is a sandy gravel, into which, as into a basin, the water from the adjoining hill percolated and lodged, oosing to the surface as the supply kept up the pressure, until by one of these drains an outlet was made through the side of the basin and the whole of this subsoil immediately became an active natural drain, and the land converted into fine turnip, wheat, and barley soil.

But in confirmation of the general adoption of deeper and more distant drains, we are told that if land of a retentive character be drained at 4 feet and 3 feet deep, the 4 feet drains will be the first to emit water; and under certain circumstances this may be the case, which has given plausibility to some very fallacious reasoning for the efficacy of deep drains under all circumstances. I could enumerate instances, where land has been drained at 3 feet deep and 30 feet apart, of very great improvement thereby; but from certain indications, after a time, that a *perfect* effect was not obtained, other drains from 5 to 6 feet deep and 120 yards apart were put in, and the result is that not a single one of the shallower drains has run since, and the land is now perfectly dry at all times. But is this any proof that the same result will follow a similar plan of operation on the uniformly tenacious subsoils? Most certainly not. Suppose 4-feet and 3-feet drains to be laid alternately throughout a clay-land field of uniform contour and tenacity, it is quite possible, and even probable, that the 4-feet will run first after rain. But take two distinct portions of such land, having similar characteristics in all respects, and drain the one at from 30 inches to 3 feet deep, and from 18 to 24 feet apart, as may be judged necessary to insure that *completeness* for which we contend, and the other with drains from 4 to 4½ feet deep, and 26 to 40 feet apart, as may be deemed sufficient, and I maintain it is a physical impossibility for these deeper drains to run before the shallower, or to dry the land in the same time, or so effectually;—that they will run the longest is manifest, and is of itself an evidence of their insufficiency.

The more clearly to demonstrate this, let us look at a section of such drains, drawn to the same scale:—

1



2

3

1—Shows 4-feet and 3-feet drains, cut alternately at 21 feet apart, under which circumstances we say, it may be probable that the deeper ones will run first after rain. Each 3-feet drain has on either side of it an opening for the exit of the water at a foot lower level, the effect of which, as you will readily imagine, may be that when the rain has percolated to the bottom of the 3-feet drain, instead of passing off, its natural tendency is to descend to the lower level, where it meets with a fully saturated bed, and having no longer a lower attraction, of course runs off by the drain at that level. This may not always be the case; but we are showing its probability, and hence that such a mode of experiment is by no means conclusive evidence that drains 4 feet deep, in clay subsoils, will emit the water sooner than 3-feet drains.

2—Is a section of land drained 3 feet deep, and at 21 feet apart.

3—A section of the same land with the drains at 30 feet apart, and 4 feet deep. And with these three sections in juxtaposition it would be a reflection on your perception to attempt any more detailed arguments to prove the truth of the assertion, that it is physically impossible for the deeper drains to run before the shallower. I shall, however, presently have the pleasure of placing before you the results of some experiments on filtration, which will still further confirm what we have advanced.

While, however, showing the superior efficacy of comparatively shallower and more frequent drains on clay-lands, it must not be understood that anything but a *safe and permanent depth* is contemplated; and which cannot, I think, be depended upon at less than about 3 feet. Assuming the general fall and breadth of the lands to be suitable, the best and most economical plan of setting out the drains will be in the furrows; and then by cutting them full 30 inches, and subsequently working down the ridges, a good 3-feet drain is secured. It is most essential, after proper and effective drainage, that the land should be laid flat, and not retained in ridge and furrow. The mechanical action of drains is two-fold—the discharge of superfluous water; and, in proportion as that is complete, the admission of atmospheric air and influence with each succeeding shower of rain or fall of dew—but if the surface of the land be such as to cause the rain to flow into the furrows, instead of sinking into the soil where it falls, it cannot be otherwise than productive of a partial action of the drains, in lieu of that *uniformity* which is always observable on naturally dry land. Why not lay turnip and barley land in ridge and furrow? Because it is dry and does not require it. And is not the same reason equally conclusive on drained land, properly dried? I saw an instance, last spring, of the bad effects of retaining the ridge and furrow after draining; and, inasmuch as it had the effect of making a convert of the prejudiced occupier, may be worth mentioning. One of a succession of tolerably strong land fields was being drained in fallow, and as the intention was to sow it with wheat I particularly requested (after a long discussion of the advantages) that it might be worked down flat. Bent, however, upon practically showing me I was wrong, and "that it would not do in that country," the occupier kept it in the old form: and the consequence was that the heavy rains washed the finer particles of the soil into the furrows, forming a puddle which prevented the action of the drains, and much of the crop was damaged. When I visited the land on the completion of the entire work, you may judge of my annoyance at seeing what had been done; but which was in some degree appeased by observing that the adjoining field was laid perfectly flat, and that the barley upon it looked particularly well. The man admitted he had seen the error and its palpable consequences on the first field, and resolved not to commit it a second time.

In the execution of what may properly be termed drainage works, *i. e.*, the draining of entire and extensive estates, it is a matter of some surprise how comparatively few are conducted upon any prescribed plan, or with any view to apply the drainage water to other useful purposes, such as irrigation, power, or ornament. The drainage of a field here, and another there, without regard to entirety of design or purpose, is the usual course, and although it might have been expected that on many of the extensive properties which are being drained under the general Act such a course could have been adopted with benefit to all parties, yet it may be doubted whether there is any one instance in which such an attempt is being made. The provisions of the original Act evidently contemplated such works, for they required the production of plans of each property, and the delineation thereon of the proposed drainage, for the inspector's consideration, suggestion, and approval; and had this systematic and safe course been adhered to some very complete works would have been the result, for general imitation; but the outcry of proprietors against what they esteemed an unnecessary trouble and expense, induced the legislature in the Amendment Act to dispense with these plans, the consequences of which may, I fear, be felt when too late. How many a homestead by a little simple engineering and suitable direction of the drainage water might be supplied with power sufficient for every purpose of threshing, grinding, chopping, &c., at a comparatively insignificant cost. How many an extra crop of grass a year might be cut from the lands of the lower levels irrigated by the drainage water from the higher grounds. And how many a town, village, and mansion, now but precariously provided, might, by a proper system of collection, conservation, and filtration of the drainage from the adjoining lands, be supplied, at an easy cost, with abundance of the purest water for every purpose. And I say *purest*, because there can be little doubt that, subjected as in such cases it would necessarily be to repeated filtration and aeration, it would not only be soft and pellucid, but more free from those mineral constituents which spring-water imbibes from the foundation on which it is found, and which are frequently very objectionable both for domestic and manufacturing purposes. And would not such a supply be preferable, at least in idea, if not in palatable reality, to that which so many of our towns now obtain by waterworks; many of which receive their supply from the river *after* it has passed the town. The consequence being that, in the summer months, it might not require any very close calculation to estimate the repetition of purposes and processes through which each gallon passes in the eight and forty hours, however disgusting the result might prove to the lovers of a pure beverage. Were an area of country thus treated, that is, the land subjected to a perfect course of drainage, and such portion of the water as it was practicable to obtain applied to other useful purposes, it would be found, after the heavy rains of autumn and spring which now swell our rivers and brooks with water washed from the surface and so thickly intermixed with the finer particles of the soil as in its deposit to choke up the outfalls of the lower lands, that it would pass off in a filtered and almost colourless condition, and thus two important results would be secured;—the best of the soil would not be washed away; and the water of the rivers would be kept comparatively pure.

And is there anything impracticable or even difficult in such an application, under ordinary circumstances and with common engineering skill? The cost too in many localities would be trifling compared with that at which towns often obtain their supply by pumping from the river level. The same mechanical means by which draining pipes are now made will mould clay sewerage pipes of any form and dimensions; and by having them of a suitable substance, well burnt, and if necessary glazed, they will bear a very considerable pressure. Pipes for the purpose of sewerage are now being made with socket-joints and glazed, and sold at 8*d.* per yard for 6 inches, and 1*s.* 10*d.* per yard for 12 inches diameter. In districts, however, where fuel is reasonable, the clay suitable without glazing, and without sockets (which I should much prefer for making a joint, as well as for other reasons) these rates might be reduced. It is very common for the Water-works of towns of 10,000 to 20,000 inhabitants to cost from 20,000*l.* to 40,000*l.*, for which of course the population must pay a handsome equivalent impost in the shape of profit to shareholders, as well as being subject to all kind of surveillance and annoyance from officials and collectors. The average fall of rain in England may be taken probably at 25 inches a year, each inch being equivalent to about 25,000 gallons per acre. Suppose, however, that we estimate the available quantities at 20 inches per annum and 20,000 gallons to the inch, we have a supply of 400,000 gallons a year from every drained acre of area from which it can be collected; therefore you will see that no very excessive extent of surface is necessary for the abundant supply of many of our towns; and in point of first cost I am persuaded that, where practicable at all, the plan indicated may be applied at one quarter the sum expended upon many existing works.

Let me now direct your attention to some of those meteorological effects which, without pretending to any very intimate knowledge of that interesting science, I nevertheless believe exercise an important influence in promoting the efficiency of drainage, as well as that completeness in that operation will in its turn have an equally observable effect over meteorological causes themselves. It is very common to speak of undrained land as being *cold,* and a more significant designation could hardly be given, for it is literally so, and that at a time when, for the purposes of vegetation, it ought to be the warmest. The following observations on evaporation and filtration (for which we are indebted to the patient and carefully conducted experiments of my relation, Mr. Charles Charnock, of Holmfield House, near Ferrybridge) present some curious facts for consideration, demonstrating the cause of, and suggesting the remedy for, this baneful coldness. (See Table in next page.)

In the first place, it is observable how much greater is the amount of evaporation from water than from land, and how near, as shown by columns 2 and 5, the evaporation from wet land is to that from water itself—hence the wetter the land the greater the evaporation, and, as the well-known consequence, the greater its excess of coldness. We have a familiar illustration of Nature's process in this particular, in the method often adopted to cool our wine on a hot summer's day, by wrapping a wet napkin round the bottle and exposing it to the full sun: as the moisture from the napkin is evaporated, the temperature of the wine declines to almost freezing-point. The school-boy's experiment of producing ice before a fire, by incasing the vessel in wet flannel and adding a portion of salt to the water, is a similar example, with this additional lesson to the farmer—that to apply certain limes to wet land is only increasing the evil.

You will then, in the second place, notice how much less the evaporation is in the shade than in the sun, and consequently that wet land must be the warmest when there is the least sun. From which cause no doubt arises that too vigorous growth of young wheat, so often observable on such land in the winter and spring months, which never fails to produce serious injury to the crop in all its subsequent stages. And, thirdly, you will remark how comparatively small a proportion of the rain which falls is shown to be carried off by filtration. Taking the average of the five years' experiments, it will be seen that only 4·82 inches, out of 24·60 inches of rain, passed through the land to the depth of three feet. We might, therefore, be led at the first glance to infer that land in general stands less in need of drainage, or may be drained by

AN ACCOUNT of OBSERVATIONS made, through a series of Five Years, at Holmfield House, near Ferrybridge, in the county of York,* by Charles Charnock, Esq., with a view to determine the amount of Evaporation and Filtration under the several circumstances on the Magnesian Limestone Soil.

MONTHS.	1842					
	Rain.	Evaporation.				Filtration.
	1	2	3	4	5	6
		From Water		From Soil.		
	On the Surface.	Exposed to both Sun and Wind.	Shaded from Sun, but exposed to Wind.	When Drained.	When Saturated.	Through the Soil from the Drain 3 feet deep.
January . .	2·70	1·69	1·13	1·66	1 59	1·04
February .	0·76	1·23	0·81	0·68	1·04	0·08
March . .	3·48	1·92	1·28	2·40	2·52	1·08
April . . .	1·51	2·98	1·99	1·11	2·31	0·40
May . . .	2·98	4·14	2·76	2·89	3·82	0·09
June . . .	1·94	4·18	2·79	1·94	4·27	..
July . . .	3·74	4·16	2·73	3·26	3·89	0·48
August . .	1·49	3·36	2·24	1·37	2·39	0·12
September	2·44	2·69	1·74	2·24	2·88	0·20
October . .	1·12	2·00	1·37	0·92	1·99	0·20
November	3·19	2·26	1·50	2·49	1·83	0·70
December	0·76	3·00	2·14	0·60	1·49	0·16
Totals .	26·11	33·61	22·48	21·56	30·02	4·55

MONTHS.	1843					
	Rain.	Evaporation.				Filtration.
	1	2	3	4	5	6
		From Water		From Soil.		
	On the Surface.	Exposed to both Sun and Wind.	Shaded from Sun, but exposed to Wind.	When Drained.	When Saturated.	Through the Soil from the Drain 3 feet deep.
January . .	1·48	2·57	1·71	0·69	1·87	0·79
February .	3·25	2·65	1·10	2·29	2·78	0·96
March . .	0·95	3·05	2·03	0·72	2·43	0·23
April . . .	2·19	3·22	2·05	1·84	2·39	0·25
May . . .	2·81	2·91	1·94	2·47	2·65	0·34
June . . .	2·31	5·12	3·41	2·10	4·86	0·21
July . . .	2·70	3·76	2·50	2·55	3·49	0·15
August . .	3·99	3·71	2·57	3·77	3·74	0·22
September	1 07	2·06	1·34	0·90	2·18	0·17
October . .	1·10	1·80	1·20	0·82	1·93	0·28
November	2·36	1·64	1·09	1·69	1·48	0·67
December	0·28	1·68	1·78	0·27	1·39	0·01
Totals .	24·49	34·17	22·72	20·11	31·19	4·28

MONTHS.	1844					
	Rain.	Evaporation.				Filtration.
	1	2	3	4	5	6
		From Water		From Soil.		
	On the Surface.	Exposed to both Sun and Wind.	Shaded from Sun, but exposed to Wind.	When Drained.	When Saturated.	Through the Soil from the Drain 3 feet deep.
January . .	1·31	1·61	1·08	0·85	1·50	0·46
February .	2·22	1·31	0·88	1·66	1·11	0·56
March . .	2.27	2·13	1·42	1·58	1·50	0·69
April . . .	0·27	3·83	2·55	0·27	3·42	..
May . . .	0·42	5·77	3·85	0·42	4·86	..
June . . .	1·24	5·31	3·58	1·20	4·95	0·04
July . . .	2·76	4·17	2·78	2·43	4·28	0·33
August . .	2·85	4·70	3·14	2·44	4·63	0·41
September	1·92	4·91	3·28	1·62	3·96	0·30
October . .	1·41	2·79	1·86	1·17	2·93	0·24
November	1·98	2·84	1·80	1·47	2·78	0·51
December	0·35	0·79	0·53	0·29	0·93	0·06
Totals .	19·00	40·16	26·75	15·40	37·85	3·60

MONTHS.	1845					
	Rain.	Evaporation.				Filtration.
	1	2	3	4	5	6
		From Water		From Soil.		
	On the Surface.	Exposed to both Sun and Wind.	Shaded from Sun, but exposed to Wind.	When Drained.	When Saturated.	Through the Soil from the Drain 3 feet deep.
January . .	1·74	1·53	1·02	1·28	1·49	0·46
February .	0·73	0·71	0·47	0·43	0·94	0·30
March . .	1·88	2·91	1·94	1·33	2·89	0·55
April . . .	1 54	4·79	3·19	1·05	4·06	0·49
May . . .	2·24	2·84	1·99	1·97	3·26	0·27
June . . .	3·18	3·10	2·06	2·93	2·98	0·25
July . . .	3·49	2·86	1·89	3·30	2·79	0·19
August . .	4·61	2·56	1·70	4·24	2·43	0·37
September	1·36	2·79	1·86	0·95	2·29	0·41
October . .	3·36	2·77	1·84	2·69	2·89	0·67
November	1·01	2·13	1·41	0·73	2·20	0·28
December	3·04	3·57	2·38	2·36	2·87	0·68
Totals .	28·18	32·56	21·75	23·26	31·09	4·92

MONTHS.	1846					
	Rain.	Evaporation.				Filtration.
	1	2	3	4	5	6
		From Water		From Soil.		
	On the Surface.	Exposed to both Sun and Wind.	Shaded from Sun, but exposed to Wind.	When Drained.	When Saturated.	Through the Soil from the Drain 3 feet deep.
January . .	2·18	2·07	1·58	1·22	1·94	0·96
February .	0·47	2·59	1·69	0·44	2·09	0·03
March . .	0·93	2·56	1·55	0·86	2·16	0·07
April . . .	5·97	1·91	1·27	2·98	1·49	2·99
May . . .	0·82	4·52	3·02	0·73	3·89	0·09
June . . .	1·65	4·88	3·25	1·58	4·73	0·07
July . . .	2·90	4·44	2·96	2·74	4·39	0·16
August . .	2·65	3·08	2·05	2·46	3·28	0·19
September	1·07	2·99	1·99	1·00	3·14	0·07
October . .	4·09	2·23	1·49	2·40	2·76	1·69
November	1·15	1·63	1·09	0·88	1·74	0·17
December	1·36	1·79	1·10	1·09	1·67	0·27
Totals .	25·24	34·69	23·04	18·38	33·28	6·76

EXPLANATION.—Column 1.—Shows the Depth of Rain fallen, as registered by the ordinary Rain-Gauge.
Column 2.—Is the Amount of Evaporation from a Surface of Water fully exposed to both Sun and Wind.
,, 3.—Is the Evaporation from Water shaded from the Sun, but exposed to the Wind.
,, 4.—Is the Evaporation from what represented drained or dry land.
,, 5.—Is the Evaporation from the same when saturated.
,, 6.—Is the Amount of Water which filtered through the soil.

Into a leaden vessel, of a foot square and three feet deep, was put two feet of gravel and calcareous sand, so as to represent the substratum of the farm, and the remainder filled up, to within an inch of the top, with an average quality of soil. At the bottom a pipe was inserted which conveyed all the water that was filtered through into a bottle, which was regularly emptied and registered. The vessel was inserted in the ground to within an inch of the surface, keeping the level of the soil, inside and outside, alike, with an inch of the vessel above, to prevent any communication of water from without. The soil was kept free from weeds, and occasionally stirred, that it might not be more than ordinarily compact.

To determine the evaporation from *saturated* soil, a leaden vessel of 13 inches deep, and a foot square, was filled to within an inch of the top with soil and placed in the ground in the same manner as the previous vessel, with a pipe level with the surface of the soil to carry off the excess of top-water into a receiver. The same quantity of water was then daily supplied to this soil as the evaporating dish of Column 2 showed was evaporated. The soil was stirred as in the former case, and thus represented wet and undrained land.

---

* Mr. C. C. is one of the Vice-Presidents of the *Meteorological Society of London.*

a less perfect system, than is supposed to be requisite, did not daily experience oppose such a conclusion. We must, therefore, endeavour to reconcile this seeming incongruity, and deduce at the same time from the facts disclosed such data as may guide us in determining the essential requisites to ensure completeness of effect in drainage.

Now, although there can be no reason to question the accuracy of the experiments on filtration made by Mr. Dickinson, and recorded in the Journal of the Royal Agricultural Society of England, vol. v. part i., yet there is a very considerable difference in the aggregate result, as shown by them and the account before us. "The first important fact disclosed," says the commentator, page 148, "is that, of the whole annual rain, about $42\frac{1}{2}$ per cent, or $11\frac{3}{10}$ inches out of $26\frac{6}{10}$, have filtered through the soil;" whereas in the Holmfield House experiments there is only shown, as we have already said, 4·82 inches out of 24·60, or about $5\frac{1}{10}$ per cent. against $42\frac{1}{2}$ per cent. This is certainly a very great and somewhat irreconcilable difference in the result of two experiments made professedly to ascertain the same fact. Now, on referring to the 'Memoirs of the Literary and Philosophical Society of Manchester,' vol. v. part ii., you will find a paper on rain, evaporation, &c., from the pen of the celebrated Dr. John Dalton (the father of the science of meteorology), wherein he explains a series of experiments made by himself and his friend Mr. Thomas Hoyle junior, to ascertain the amount of evaporation and filtration, and giving the following table of results, viz.:—

Months.	Water through the Two Pipes.			Mean.	Mean Rain.	Mean Evaporation.
	1796.	1797.	1798.			
January . .	1·897	·680	1·774	1·450	2·458	1·008
February . .	1·778	·918	1·122	1·273	1·801	·528
March . . .	·431	·070	·335	·279	·902	·623
April . . .	·220	·295	·180	·232	1·717	1·485
May . . .	2·027	2·443	·010	1·493	4·177	2·684
June . . .	·171	·726	..	·299	2·483	2·184
July . . .	·153	·025	..	·059	4·154	4·095
August . .	..	..	·504	·168	3·554	3·386
September . .	..	·976	..	·325	3·279	2·954
October . .	..	·680	..	·227	2·899	2·672
November . .	..	1·044	1·594	·879	2·934	2·055
December . .	·200	3·077	1·878.	1·718	3·202	1·484
	6·877	10·934	7·379	8·402	33·560	25·158
Rain . . .	30·629	38·791	31·259			
Evaporation . .	23·725	27·857	23·862			

"Having got a cylindrical vessel of tinned iron," says the Doctor, "ten inches in diameter and three feet deep, there were inserted into it two pipes turned downwards for the water to run off into bottles: the one pipe was near the bottom of the vessel, the other was an inch from the top. The vessel was filled up, for a few inches, with gravel and sand, and all the rest with good fresh soil. Things being thus circumstanced, a regular register has been kept of the quantity of rain-water that ran off from the surface of the earth through the upper pipe (whilst that took place), and also of the quantity of that which sank down through the three feet of earth, and ran out through the lower pipe. A rain-gauge of the same diameter was kept close by, to find the quantity of rain for any corresponding time."

You will notice that the general result of these experiments accords pretty nearly with that of the Holmfield account; and yet it may be readily conceived that circumstances of situation and stratification may often occasion as wide a difference in the amount of filtration as is shown between Mr. Dickinson's and Mr. Charnock's observations.

On an examination of the *details* registered in the account before us, it will be evident that the amount of filtration is not exclusively dependent on the fall of rain; but that a variety of other causes combine to affect its proportion. For instance, in March, April, May, June, and July, of 1842, the fall of rain was 13·65 inches, and the filtration for the same period was only 2·05 inches; whilst in April, 1846, there was 5·97 of rain and 2·99 of filtration. Similar instances are also noticeable in Mr. Dickinson's details. From March to October, inclusive, of 1840, a fall of 11·52 inches of rain is recorded, without any filtration; but in November, 1842, the rain was 5·77, with 5 inches of filtration. Dr. Dalton's table also shows the same variations. The lesson, therefore, derivable from these experiments, so far as regards filtration by drains, is one rather of a speculative than of a definite character; for, although we are assured filtration must be secured, we are left with a large and varying margin as to the proportion. We must not, however, overlook the fact, that all the registered details show occasionally an amount of filtration nearly equal to the rain that falls, and therefore, in determining the size of pipe to be used, the ready exit of this *maximum* quantity must be provided for.

Considering the Holmfield House observations as a whole, and the result of each experiment in conjunction with the others, they establish very conclusively this important fact—that drainage, to be *complete* in its effects, must secure the greatest and most uniform amount of filtration of which the land is capable with a given outlay; for of course there is always a compensating balance between cost and effect to be regarded. Seeing then that, even in a comparatively open subsoil of gravel and calcareous sand, this desirable proportion of the rain that falls only very occasionally passes off by filtration at a depth of 3 feet, how is it possible in the retentive clay subsoils to obtain the proper proportion at a depth of 4 feet, with any wide interval between the drains? A judicious difference may be made where the land is intended to remain permanently in grass, and where it may be sufficient to remove merely the really injurious surplus water, without laying it so perfectly dry as is essential to the most profitable cultivation of arable land. Much has of late been said upon the efficacy of what are termed air-drains—that is, a drain at the head of the field connected with each of the parallel drains, and so with the main-drain, producing a current of air through the whole. In a former paper before the Wakefield Farmer's Club in 1843, and which was published at the request of that body, I suggested the adoption of head-drains, showing, as I then conceived, their benefit; but further reflection led me to doubt their advantage, and to discontinue their application. They not only add to the cost of the work, but, having a current of air through the drains, must necessarily tend to the early decay of all the pipes of a perishable character, as we see exemplified in the brickwork of many of the railway tunnels; as well as to promote the growth into the pipes of any roots that may approach them.

There yet remains to be attained one other desideratum in the execution of drainage, which perhaps more than any other would facilitate the operation and reduce its cost, and so in all the strong clay lands allow of the drains being sufficiently near to ensure completeness without an extravagant outlay. I allude to the application of some better mode of cutting the drains, either wholly or in part mechanical, whereby a more suitable section of cut would be obtained without the removal of so much of the subsoil as is now necessary. A course of experiments are being made, which, so far as they have yet gone, promise success, and I hope ere very long to be able to announce the attainment * of the object.

York, Oct. 1849.

---

* I am since fully satisfied, by further experiments, of the practicability of constructing a very efficient implement, to be worked by manual power, whereby the cutting of drains to a depth of 3 feet in suitable subsoils may be accomplished at a cost of ¼d. per yard, in lieu of ¾d. as by the present means, and without encumbering the land with so much of the subsoil.

XXVII.—*On the Causes of the general Presence of Phosphates in the Strata of the Earth, and in all fertile soils; with Observations on Pseudo-Coprolites, and on the possibility of converting the Contents of Sewers and Cesspools into Manure.*—By W. Buckland, D.D., Dean of Westminster.

Professor Liebig five or six years ago invited the attention of agriculturists to the possibility of applying to the same use as bone-dust and guano the fossil bones and coprolites which occur together in certain beds of the lias formation. This invitation took place not many months after I had the honour of conducting him to the well-known bone-bed in the lower region of the lias, at the Aust Passage Cliffs, on the left bank of the Severn, near Bristol, where two beds of lias (each from one to two feet thick) are densely loaded with dislocated bones and teeth and scales of extinct reptiles and fishes, interspersed abundantly with coprolites derived from animals of many kinds, which seem to have converted that region into the cloaca maxima of ancient Gloucestershire, at the time of the commencement of the formation of the lias. Coprolites are also dispersed plentifully through the strata of many other parts of the lias, *e. g.* on the coast at Lyme Regis; but neither there nor in the bone-bed at Aust Passage is a sufficient quantity accessible at a cost that would repay the digging for the express purpose of collecting these mineralized fragments of skeletons and fæcal balls of digested bones for use as a substitute for recent bone-dust or guano.

Geologists have long been acquainted with the abundant occurrence of rolled fragments of the bones and teeth of large quadrupeds, and of whales and sharks, and also of the bones and teeth of many marine fishes, in the tertiary beds of gravel and shells, called crag, in the counties of Norfolk and Suffolk; and in 1846 Professor Henslow laid a paper before the British Association at Cambridge, on the abundant occurrence of the ear bones of whales in the crag beds of Felixstow, on the coast of Suffolk, together with large quantities of rolled pebbles of phosphates of lime (which he then supposed to be coprolites) among the miscellaneous gravel and shells that compose the bulk of the crag formation.

About this time also, Professor Solly's analysis of these supposed coprolites proved their chemical composition to be nearly identical with that of real coprolites from the lias; and the attention of agriculturists was invited to their use as a manure of nearly equal value with guano or bone-dust. Mr. Solly's advice to agriculturists to make use of this newly discovered storehouse of fertility has been duly responded to; and many thousand tons of these pebbles and bones have been collected from the shore near Felixstow; whilst many occupiers of inland farms near Felixstow and Woodbridge have been and are still collecting similar pebbles from superficial beds of gravel of the crag formation, varying in thickness from one foot to many feet, and extending over areas of variable extent and irregular forms, modified by the sweep of currents, by which the bottom of the tertiary sea was affected during the formation of the crag.

The contents of these crag gravel-beds are of three kinds,—1. Siliceous sand, and rolled chalk-flints and miscellaneous gravel. 2. Marine shells, and rolled bones and rolled teeth of land quadrupeds and fishes. 3. Rolled pebbles, resembling cropolites, among many thousands of which in the collections of Professor Henslow and Professor Solly, I have never found one that has just pretensions to that name and title ; although, from this accidental fictitious resemblance, the name of coprolite manure has obtained an agricultural and commercial currency, which now cannot be withdrawn, but to which the name of *pseudo-coprolite* would be more appropriate; better still would be the name of phosphorite, which I shall use in the following observations.

Mr. Lawes has established, on the east bank of Deptford creek, near Greenwich, very extensive works for grinding to powder these false coprolites or phosphates, and my attention will be directed—1. To the origin of the pebbles, and the causes which have charged them with phosphoric compounds. 2. To the causes that have dispersed similar phosphoric compounds through nearly all rocks and soils. 3. To the possibility of imitating the natural processes that co-operated to their production, and of converting the valuable phosphates of our sewers to the manufacture of a similar manure, by placing sewage-water in conditions analogous to those which attended the formation of phosphates in the *crag,* and in other strata formed at the bottom of ancient seas and lakes.

We may here observe that the presence of peroxide of iron, which pervades all these pebbles, and incrusts or pervades also all the rolled fragments of bones and teeth, and the shells of the crag formation, may be an accident not essential to the production of the phosphorites, though possibly auxiliary to or connected with it.

I believe the essential condition was the admixture (in a fluid or semi-fluid state) of all the now consolidated ingredients of the marlstone and of the septaria (which we use to make our Roman cement), viz., of clay, carbonate of lime, and protoxide of iron, in a state of mud on the sea bottom, at the time of the disengagement of phosphoric compounds from the dung and putrefying bodies of fishes, and of molluscous animals and marine worms, at the bottom of the seas in which the deposition of the London clay was going on. These conditions that attended the deposition of the material of the London clay, were similar to those attending the deposits of sedimentary mud (subsequently converted to beds of clay and marl) in all geological formations, since the waters were first peopled with swimming creatures of ten thousand kinds, with creeping things innumerable, both small and great beasts.

From the first creation of fishes to fill and multiply in the waters, there must have been a never-ceasing deposition of phosphoric compounds in every bed of mud that was in progress of accumulation at the bottom of all inhabited portions of seas, and lakes, and rivers; and thus the fæcal dejections of all subaqueous animated nature must, by their decomposition, have supplied daily and hourly accessions of matter convertible to phosphorite.

There must have been also a further never-ceasing supply of phosphates from the decay of the bodies of all these animals after their death, *i. e.*, from the dead bodies of all fishes and molluscs and sea-worms that were not devoured by other animals.

From these twofold sources incessant additions of phosphoric matter must at all times have been falling into decay, and mixing phosphoric compounds with the earthy sediments at the bottom of all inhabited waters; and these incessant and almost universally diffused supplies of animal exuviæ must, in the act of decomposition, have been continually evolving phosphoric compounds in the nascent state, which is the state most apt to enter into new chemical combinations.

Where the bottom of the sea was covered only with siliceous sand, no phosphoric combinations could take place; and hence the barrenness of the great siliceous sandy deserts of the world; but wherever the bottom of the water contained (in an unconsolidated state) the ingredients of future marl, or marlstones, or septaria, conditions were present favourable to the formation of the new combinations of phosphorite.

Now, as both phosphate and carbonate of lime are soluble in water charged with carbonic acid, and as carbonic acid is one of the most abundant substances in nature, evolved under all kinds of animal and vegetable decay, it follows that wherever decomposition of fæcal dejections, or of dead animals, or of sea-weeds was going on, over the entire bottom of all the ancient seas, and great oceans, beds of these cumulative additions, in every day and every hour of antediluvian time, became the grand receiver-general and cloaca maxima of the terraqueous globe, an universal laboratory and conservative storehouse of universally dispersed manurance for the future corn-fields and pastures of the earth, when these ancient sea-bottoms should be raised up to become dry lands, and in process of time be converted into vineyards and oliveyards, and lands of wheat and barley, for the sustentation of man, and of land animals, of higher functions and higher organization than those multifold generations of marine reptiles, and fishes, and worms, and creeping things which were the appointed purveyors of future food for man, destined by the functions of their daily digestion, and of their life and death and decay, to lay up stores of universal fertility in the deep foundations of the earth, and to prepare the nascent strata in the very act of their construction, to become, in due time, a grateful soil to reward the labours of the agriculturist.*

As the processes we have been tracing in the London clay are types of operations that have more or less pervaded all deposits formed under water, in all formations, I will state further particulars respecting this London clay. Phosphoric matter, elaborated in the bodies of animals, has not only become combined with the earthy ingredients of its larger septaria, the Roman cement stones, but also with the millions of minor concretions that crowd the London clay, and which often envelope fragments of some animal or vegetable that formed a nucleus around which the materials of these concretions were collated and aggregated while in a fluid state.

Many of these half-calcareous concretions in the London clay contain enough of phosphoric matter to place them in the family of *pseudo-coprolites,* the history of which, in other formations, I shall presently describe; we are now considering the fate and fortune that has attended these minor phosphoriferous concretions of the London clay. From their matrix in the London clay they were dislodged by the waters of the seas of the *eocene* period, and accumulated by myriads at the bottom of those shallow seas where is now the coast of Suffolk. Here they were long rolled, together with the bones of large mammalia and fishes, and with the shells of molluscous creatures that lived in shells. From the bottom of this sea they have been raised to form the dry lands along the shore of Suffolk, whence they are now extracted as articles of commercial value, and ground to powder in the mills of Mr. Lawes, at Deptford, to supply our farmers with a valuable substitute for guano, under the accepted name of *coprolite manure.*

But it is not certain that these pseudo-coprolites collected all their phosphates whilst they were in the London clay. It is possible that many, if not all of them, and also many fragments of the larger septaria, which we find rolled and broken in the crag, may have absorbed a larger dose of phosphorus than they contained before

---

* This self-same process, which has been made to lay up in every stratum, during the act of its formation, stores of fertility for the then future lands and continents, produced a simultaneous reaction advantageous to the sanitary state and habitability of the waters of the sea; for had not this or some other process of purification been in continual operation, from the time when living things of all dimensions, from the infusorial animalcules to the sharks and great sea lizards and whales (Enaliosauri and Ceteosauri), were first created to inhabit the sea, the exuviæ of these myriads (notwithstanding diffusion) would, in a few centuries, have tainted all oceans and waters with impurities exceeding those of which we hear so much complaint in the waters of the Thames at London Bridge.

they were washed out of their matrix in the London clay, from the dejections and decaying bodies of fishes and molluscs and worms, that inhabited the tertiary sea, at whose bottom they were for a long time rolling, while the gravel of the crag was in process of formation.

The bodies of the molluscous creatures that inhabited the very shells of which the crag is composed, must have given out phosphoric compounds during their decay, which may, by absorption, have supplied additional phosphoric matter to that which these concretions brought with them from their matrix in the London clay. Experiments are wanting to show whether concretions of other fragments of marlstone, and of marl, and chalk, and soft limestone, bathed in sewage water, mixed with salt enough to equal that in sea-water, and with peroxide of iron, and burnt clay, and at a temperature approaching the probable warmth of the shallow sea-water in which the crag was formed, may absorb and form similar phosphoric compounds from the ingredients of sewage. I earnestly commend such experiments to the care of the many accomplished chemists who are now directing their attention to sanitary and agricultural improvements.

There seems to be little doubt as to the power of the chemical agents I have spoken of, the chief difficulty lies in the *time* required to effect the desired combinations. Experiments on this subject are at the present time of pressing importance, with a view to the grand desideratum of turning to a profitable use the noxious contents of our sewers. The great difficulty seems to lie in discovering a method of expediting the processes of combination.*

In many of the red marl districts, from Devonshire to Durham, through the entire centre of England, it is the practice to lay quicklime in long heaps parallel to the hedges of fields under preparation for wheat, and to mix lime with the vegetable rubbish and rough soil from the ditch and foreland margin of the field; these are left together many days before the compound is laid on the furrows, and ploughed into the soil before the wheat is sown.

---

* The stronger affinity of lime for carbonic than for phosphoric acid may cause a decomposition and conversion of carbonate of lime, or of marl, or marlstone, or chalk, into phosphate of lime by a substitution of phosphoric for carbonic acid; and a similar effect might follow if slightly baked or sun-dried clay or marl, or powdered chalk, be submerged in sewage. The result being (as Dr. Lyon Playfair has suggested) a kind of exchange and pseudomorphic conversion of carbonate to phosphate of lime. It is probable that by a similar process the phosphorites were formed in all the strata of the crag. But the formation of these strata occupied longer periods of time than the chemists have at their disposal, and the great desideratum to which I would call attention, is the discovery of a cheap and easy method of accelerating this process. I repeat what I have before stated, that the addition of carbonic acid to sewage, and of protoxide of iron and salt, and moderate heat, may induce conditions, approaching to those under which analogous compounds were formed from putrescent animal and vegetable matter in ancient deposits, both under salt and fresh water, throughout all geological time.

The efficacy of this manure may in part be due to the decomposition of the phosphates contained by the vegetable rubbish, and by the weeds and roots in the soil of the field, during two or three weeks' contact with quicklime.*

The practice of manuring with quicklime for a crop of wheat, though not exclusively limited to the red marl districts, pervades all those parts of England in which this kind of red soil prevails; and as Dr. Lyon Playfair has found phosphate of lime in very many samples of this marl, it may exist more or less through its whole extent.

Before the introduction of lime as a manure, more than one hundred years ago, the preparation for wheat was a coat of red marl, the decomposition of which, by the winter's atmospheric action, must have set free many of its phosphoric and other ingredients. Quicklime produces a similar effect more rapidly. By the first rain that falls upon it, lime-water is formed; this lime-water (by its affinity for carbonic acid) disengages from the carbonate of lime within the marl, enough cabonic acid to make it dissolve further quantities of carbonate of lime, and also of phosphate of lime, from the phosphoriferous marl, in a state fit to be absorbed by the next crop of corn.

It has been stated that the quicklime sets free carbonic acid from all the vegetable matter in the soil to which it is applied, and that this acid decomposes and renders soluble not only the phosphoric and numerous other compounds of vegetable matter present in the clods (viz. old roots and stems and dead leaves), but also any mineral phosphoric compounds that may be present in the marl. The practice of laying marl on land under preparation for wheat, was in use a century and a half ago in Devonshire, and through the Midland districts, extending thence N.E. through Worcestershire and Staffordshire, into the south of Derbyshire, and along the valley of the Trent and vale of York, to the mouth of the Tees. Fields on the red marl through this district are full of old deep marl-pits, that were abandoned as soon as the cessation of the use of marl followed the introduction of lime, which was found to be a more quickly acting and more efficient substitute.

---

* The accepted explanation of the use of lime has been, that it hastens the decomposition of all animal and vegetable matter in the soil, and reduces it to a state soluble in water, and fit to be absorbed by the new crop. Now as one of the essential elements of this crop is phosphorus, should any fixed phosphates be present in the soil or subsoil, they also would be decomposed in consequence of the lime setting free carbonic acid from fragments of dead plants present in the soil; this acid (being absorbed by rain water) enables it to dissolve both carbonate and phosphate of lime from any fixed carbonate or phosphate of lime contained in the marl.

XXVIII.—*Report on the Exhibition and Trial of Implements at the Norwich Meeting,* 1849. By H. S. Thompson.

CONTENTS.

The Eastern Counties have long been celebrated for the manufacture of agricultural machinery; and on the occasion of the Society's late Meeting at Norwich great exertions were made by the implement-makers of that district to maintain their well-earned reputation. The number of implements at York was unprecedentedly large, yet three hundred more were exhibited at Norwich; and it is satisfactory to be able to trace from year to year a gradual weeding out of bad implements, and a progressive improvement in their general principles of construction, which is highly encouraging to those who take an active interest in this department of the Society's proceedings.

On no occasion has this improvement been more marked than at the last Meeting, and it was particularly observable in the steam-engines, carts, and waggons. The nature of the improvements introduced into these machines will be described in a subsequent part of this report, and it will be sufficient to state here that the rapid progress made in these cases may be partly attributed to the improved mode recently adopted of testing the machines under trial, and partly to the greater degree of precision with which their faulty construction was pointed out in the reports of the judges at the York meeting.

This opinion is one the correctness of which it is desirable to ascertain, as, if true, it goes far to prove that the rapidity with which the improvement of agricultural implements progresses is materially influenced by the mode of trial adopted, and the kind of judges employed by the Royal Agricultural Society. The whole question, therefore, has an important bearing on the future management of these trials; and to obtain data for arriving at a sound conclusion respecting it, it will be necessary to give a brief sketch of the progress which the Society has hitherto made in rendering the exhibition and trial of implements effective for the purposes for which they were designed.

The Society's early shows of implements must be viewed chiefly in the light of bazaars or expositions. Those who attended the Cambridge meeting in 1840 will not have forgotten the brilliant collection of implements exhibited by the Messrs. Ransome, and though every one praised the excellence of their workmanship, and admired the skill with which eighty different kinds of ploughs were grouped tier above tier with artistic effect, still it was evident that this imposing array was not prepared in anticipation of such a searching ordeal as that to which candidates for prizes are now subjected, but was rather intended to teach the visitors what sort of implements they ought to have, and to show them to what perfection this branch of manufacture had been brought.

Nor could it well have been otherwise, since the knowledge of these matters possessed by a few of the leading manufacturers was quite in advance of the general agriculture of the day. Neither stewards nor judges had yet acquired the experience requisite for the adequate discharge of their office, so that such men as Messrs. Garrett, Hornsby, Ransome, and a few others would have laughed in their sleeves had they been told that they could learn anything in the Society's show-yard. In spite, however, of a creditable display on the part of a few leading firms, the majority of the implements exhibited at these early shows were of inferior construction and workmanship, and the general appearance of the exhibitions meagre and unsatisfactory.

The attention of some of the leading members of the Society (especially of the late lamented Mr. Handley) was earnestly directed to the improvement of this department, and they soon perceived that little was gained by collecting implements in a show-yard for people to gaze at, unless an adequate trial could be made of their respective merits. To attain this end great exertions were made, and every improvement in the mode of trial was followed by so marked an increase in the number and merit of the implements brought forward at subsequent shows, as to prove the strongest incentive to further effort.

At the Cambridge and Liverpool meetings, when these trials were in their infancy, their main attraction consisted of ploughing-matches on a large scale, which gratified sight-seers, but gave no results that could be depended upon, and, therefore, disappointed all practical men. It would occupy time unnecessarily to trace the gradual changes which have led to the discontinuance of these showy exhibitions, and the substitution in their place of quiet business-like trials in the presence of stewards and judges alone. Suffice it to say, that what they have lost in display they have gained in efficiency, and, consequently, in favour with those classes for whose benefit they were designed. At the York meeting the improved mode of trying the threshing-machines supplied a deficiency which until that time had been much felt, viz., the absence of any means of ascertaining the amount of power expended in working the machines under trial ; and it may now be asserted with some confidence that, with the exception of an occasional error or accident, the best implements are uniformly selected for prizes.

It now remains to answer the question proposed for consideration, viz., to what extent the great improvement made of late in agricultural implements is due to the exertions of this Society, and with this view a tabular statement is subjoined, which shows the relative extent and importance of the Society's two first and two last shows of implements :—

		No. of Exhibitors.	Awards.	
			Money.	Medals.
			£.	
1839	Oxford	23	5	4
1840	Cambridge	36	0	7
1848	York	146	230	21
1849	Norwich	145	364	13

From this it will be seen that at Cambridge, where the trial of implements was confined to one day and was in other respects so immature as to be of little practical value, the number of exhibitors was only thirty-six, and the judges, in whom a certain discretionary power was vested, awarded no money and but seven medals, in consequence of the scarcity of objects deserving of reward; whilst at York, eight years after, when the trials lasted several days and had attained a considerable degree of perfection, the number of exhibitors had increased fourfold. The additional amount offered in prizes at the later meetings has undoubtedly assisted in creating this great increase of competition, but it cannot be considered the principal cause, since the implement-makers are unanimous in declaring that, even when most successful, the prizes they receive do not reimburse them for their expenses and loss of time. How then are the increased exertions of the machine-makers to be accounted for? Simply by the fact that the trials of implements have gradually won the confidence of the farmer, so that when selecting implements for purchase, he gives the preference to those which have received the Society's mark of approval. This inference is corroborated by the makers themselves, who readily admit that the winner of a prize for any implement of general utility is sure to receive an ample amount of orders, and that the award of a medal is worth on an average 50*l.*

It thus appears that concurrently with the extension and improvement of the trials, a corresponding increase and improvement has taken place in the exhibitions of implements, and though it is difficult to *prove* that the one has been the cause of the other, still the probability that such is the case almost amounts to certainty when it is found that classes of implements which are so faulty in construction as to be strongly animadverted on by the judges at one meeting, are at the next nearly free from those defects which had been previously pointed out. This is precisely what has occurred during the past year in the case of carts and steam-engines, which were severely criticised at York, and found to be greatly improved at Norwich in those points to which attention had been specially directed.

If the foregoing reasoning be correct (and the facts on which it is founded will not admit of question) the Society may fairly claim to have been in great measure the authors of the very rapid improvement made of late in almost every kind of agricultural implement. The managers of the Society have, therefore, every reason to be satisfied with the past, and it may perhaps not be thought presumptuous to endeavour briefly to show that the prospect for the future is equally encouraging.

It has been already stated that the trials as at present conducted are effectual for the selection of the best implements exhibited. To have obtained this result is to have done much—it is, in fact, to have attained all that has hitherto been contemplated or desired; no sooner, however, had it been secured than another point of equal importance suggested itself, and the experience of the Norwich meeting has shown it to be no less attainable than the good results which have already been realized. The object alluded to is to obtain so accurate a register of the force required to work the different kinds of agricultural machinery, that the public and the manufacturers themselves may be informed whether the results obtained are satisfactory, when compared with the means employed. The same arrangements which are required for deciding this question will also in certain cases be useful in showing in a complex machine the respective efficiency of its several parts. To make this more plain, it may be said that what has been hitherto accomplished has been limited to selecting the best of a class—the point now aimed at is to decide whether that class is a good one; whether, therefore, the best implement in it possesses intrinsic merit, and, if not, which are the defective parts which require amendment. A good illustration of the importance of this object occurred in the trial of threshing-machines at Norwich, where two of the best machines produced very nearly equally good results. When, however, the different parts of these machines were separately examined, one was found to excel very much in its horse-works, the other in its barn-works, so that it is fair to presume that if they could have borrowed from one another, both would have been improved, and at any rate neither of them are as good as they will probably be made now that their deficiencies have been pointed out.

The full importance of this question will probably not be recognised at first sight, but it is one which will assuredly be more and more appreciated in proportion as the necessity becomes more apparent for increasing the amount of capital applied to the cultivation of the land. Leaving all political probabilities and improbabilities out of the question, it is clear that the British farmer is exposed to constantly increasing competition, and it becomes him to take a rational survey of the means which he possesses for meeting it, and to consider in what way he can make the most of the resources within his reach. Whilst making such an estimate of his position, he can scarcely fail to perceive that the abundance of British capital and the superiority of British machinery are important items in his favour when called upon to contend against the superior climate of other corn-growing countries; and without mooting the question whether or no these alone will enable him to maintain his position, it is yet sufficiently clear that if he neglects these advantages he cannot retain the prominent place he now occupies amongst the leaders of the agricultural world. It would be foreign to the subject of the present report to offer any suggestions respecting the use of additional capital, except in so far as it applies to increasing the use of machinery for farming purposes; and when considering this point, the question immediately arises, In what does excellence in machinery consist? In any other branch of industry it would not be necessary to ask this question, as not only are all the manufacturing community aware that their profit, nay, their living depends on obtaining any desired result with the smallest possible amount of motive power, but they are provided with tests by which any undue expenditure of force would be at once detected. This, however, is quite out of the farmer's reach, and it is therefore necessary to tell him that a machine which makes good work may nevertheless be a bad machine, a wasteful one that is—which it is very expensive for him to use. This is precisely the case where a great national society may confer a great national benefit, by stepping in between the manufacturer and the public, and telling the former that if he wishes for the Society's award of merit, he must submit to the most searching test which scientific engineers can devise, one which shall enable the Society to point out those cases where a machine requires the expenditure of two bushels of corn (in horse-keep) or two bushels of coal (for steam-power), where only one ought to have done the work. Many will doubtless think it a hopeless task to introduce such accuracy into the trials of farming implements, but it will be sufficient to refer them to what took place at Norwich, where, with Mr. Amos's excellent arrangements and ingenious apparatus, great progress was made in convincing even the makers themselves of the feasibility and advantage of the new mode of trial. One exhibitor of a threshing-machine (a winner, too, of more than one important prize at this meeting) publicly confessed that he did not know how a threshing-machine ought to be made until he had witnessed the trial on that occasion. In the case also of drain-tile machines, the merits of two were very nearly balanced until the hand-power machines showed a considerable difference in the power required to work them. This had previously escaped notice, but when thus accurately recorded it materially influenced the decision of the judges. Other instances might be quoted, but enough has been said to warrant the assumption that if so much was accomplished when the arrangements were confessedly incomplete, it is reasonable to anticipate that by judicious encouragement on the part of the Society the trials of implements may be made productive of still higher benefits to the farmer than they have hitherto been.

PRIZES OFFERED BY THE SOCIETY.

For the Plough best adapted to heavy land	Five Sovereigns.
For the Plough best adapted to light land	Five Sovereigns.
For the Plough best adapted for General Purposes	Five Sovereigns.
For the best Paring Plough	Five Sovereigns.
For the best Subsoil Pulverizer	Five Sovereigns.
For the best Drill for general purposes, which shall possess the most approved method of distributing Compost or other Manures in a moist or dry state, quantity being especially considered	Fifteen Sovereigns.
N.B.—Other qualities being equal, the preference will be given to the Drill which may be best adapted to cover the manure with soil before the seed is deposited.	
For the best Corn Drill	Ten Sovereigns.
For the best Turnip Drill on the flat, which shall possess the most approved method of distributing Compost or other Manures in a moist or dry state, quantity being especially considered	Ten Sovereigns.
N.B.—Other qualities being equal, the preference will be given to the Drill which may be best adapted to cover the manure with soil before the seed is deposited.	
For the best Turnip Drill on the ridge, which shall possess the most approved method of distributing Compost or other Manures in a moist or dry state, quantity being especially considered	Ten Sovereigns.
N.B.—Other qualities being equal, the preference will be given to the Drill which may be best adapted to cover the manure with soil before the seed is deposited.	
For the best Drop Drill for depositing Seed and Manure	Ten Sovereigns.
For the best Horse Seed Dibbler	Ten Sovereigns.
For the best Hand Dibbler	Three Sovereigns.
For the best Barrow Hand Drill, to work with cups	Three Sovereigns.

For the Manure-Distributor which is best adapted for distributing broadcast any kind of compost or hand-tillage when in a moist state, and which is capable of adjustment for the delivery of any quantity from Two to Twenty bushels per acre	Five Sovereigns.
For the best Liquid Manure Distributor	Five Sovereigns.
For the best Heavy Harrow	Five Sovereigns.
For the best Light Harrow	Five Sovereigns.
For the best Norwegian Harrow	Five Sovereigns.
For the best Scarifier	Ten Sovereigns.
For the best Cultivator or Grubber	Ten Sovereigns.
For the best Horse Hoe on the flat	Ten Sovereigns.
For the best Horse Hoe on the ridge	Five Sovereigns.
For the best Horse Rake	Five Sovereigns.
For the best Machine for making Draining Tiles or Pipes for Agricultural purposes. Specimens of Tiles or Pipes to be shown in the Yard: the price at which they have been sold to be taken into consideration, and proof of the working of the Machine to be given to the satisfaction of the Judges	Twenty Sovereigns.
For the best Set of Tools for General Draining	Three Sovereigns.
For the best portable Steam-Engine, applicable to Threshing or other Agricultural purposes	Fifty Sovereigns.
For the second best ditto, ditto	Twenty-five Sovereigns.
For the best and most economical Steaming Apparatus for general purposes	Five Sovereigns.
For the best portable Threshing Machine applicable to Horse or Steam-power	Twenty-five Sovereigns.
For the best Corn-Dressing Machine	Ten Sovereigns.
For the best Grinding-Mill for breaking Agricultural produce into fine Meal	Ten Sovereigns.
For the best Linseed and Corn-Crusher	Five Sovereigns.
For the best Chaff-Cutter	Ten Sovereigns
For the best One-Horse Cart	Ten Sovereigns
For the best Harvest Cart	Ten Sovereigns.
For the best Waggon	Ten Sovereigns
For the best Haymaking Machine	Five Sovereigns.
For the best Gorse-Bruiser	Five Sovereigns.
For the best Turnip-Cutter	Five Sovereigns.
For the best Oilcake Breaker	Five Sovereigns.
Miscellaneous Awards and Essential Improvements	Silver Medals estimated at Twenty-six Sovereigns.
For the Invention of any New Implement	Such sum as the Council may think proper to award.

PRIZES OFFERED BY ROBERT AGLIONBY SLANEY, ESQ., M.P.

For the best Drain-Plough, to cut out, at one, two, or three cuts, to the greatest depth, with not more than four horses, so as to prepare a drain so far for deeper cutting	Ten Sovereigns.
For the best Plough, to fill in the soil cast out of drains, with not more than four horses (two and two abreast), and not to exceed 5*l.* in cost .	Ten Sovereigns.

JUDGES.

William N. Parsson	Gravel Lane, Southwark, Surrey.
Charles John Carr	Belper, Derbyshire.
William Lister	Dunsa Banks, Yorkshire.
Henry Taylor	Dilham, Norfolk.
Owen Wallis	Overstone Grange, Northamptonshire.
William Shaw	Far-Coton, Northamptonshire.
Thomas Hawkins	Assington Moor, Suffolk.
Peter Love	Naseby, Northamptonshire.
Thomas W. Granger	Stretham Grange, Cambridgeshire.
J. H. Nalder	Alvescot, Gloucestershire.

Consulting Engineer—Charles Edwards Amos (of the Firm of Easton and Amos), The Grove, Southwark, Surrey.

AWARDS.

Description of Implement and Name of Exhibitor.	Prize.	Reference to Catalogue.		
		Stand.	Article.	Price.
				£. *s.* *d.*
Ploughs.				
To William Williams, of Bedford, and Lawrence Taylor, of Cotton End, near Bedford, for their Patent Wrought-Iron Plough with Two Wheels, for heavy land, marked U S; invented, improved, and manufactured by William Williams, of Bedford . .	£5	122	11	4 15 0
To John Howard and Son, of Bedford, for their Patent Iron Plough with Two Wheels, for light land, marked J D; invented and manufactured by the exhibitors . .	£5	37	5	4 12 0
To William Ball, of Rothwell, near Kettering, for his Iron Plough for general purposes, marked "Criterion" Plough; invented by the exhibitor, and improved by James Biggs, of Desborough	£5	98	2	4 0 0
To George Kilby, of Queniborough, near Leicester, for his Turf and Stubble Paring Plough; invented, improved, and manufactured by Thomas Glover, of Thrussington, near Leicester	£5	86	2	5 10 0
Subsoil Pulverizer.				
To James Comins, of Southmolton, for his Iron Subsoil Pulverizer; invented, improved, and manufactured by the exhibitor . . .	£5	18	6	4 7 6

AWARDS.

Description of Implement and Name of Exhibitor.	Prize.	Reference to Catalogue.				
		Stand.	Article.	Price.		
				£.	*s.*	*d.*
DRILLS.						
To Richard Hornsby, of Spittlegate, Grantham, for his Drill for general purposes, and Depositing Compost; invented, improved, and manufactured by the exhibitor	£15	65	1	53	0	0
To Richard Garrett and Son, of Leiston Works, near Saxmundham, for their Eleven-row Lever Corn-Drill; improved and manufactured by the exhibitors	£10	81	10	27	0	0
To Richard Hornsby, of Spittlegate, Grantham, for his Six-row Turnip Drill on the flat, and for Depositing Compost; invented, improved, and manufactured by the exhibitor	£10	65	3	29	0	0
To Richard Garrett and Son, of Leiston Works, near Saxmundham, for their Two-row Turnip Drill on the ridge, and for Depositing Compost; invented and manufactured by the exhibitors	£10	81	8	21	5	0
To Richard Garrett and Son, of Leiston Works, near Saxmundham, for their Patent Drop Drill on the flat and ridge; invented and manufactured by the exhibitors	£10	81	9	24	5	0
HAND SEED-DIBBLE.						
To Dr. Newington, of Knowle Park, Frant, near Tonbridge Wells, for his Patent Economic Hand Seed-Dibble; invented by the exhibitor, and manufactured by Mary Wedlake and Co., of Hornchurch, near Romford, and Penfold, of Ticehurst, Sussex	£3	16	1	3	15	0
HAND-BARROW DRILL.						
To John Holmes, of Norwich, for his Hand-Barrow Drill, to work with Cups; invented, improved, and manufactured by the exhibitor	£3	36	21	2	10	0
To William Crosskill, of the Iron Works near Beverley, for his machine for Distributing Pulverized Manures broadcast; invented, improved, and manufactured by the exhibitor	£5	26	51	10	10	0
LIQUID-MANURE DISTRIBUTOR.						
To Robert and John Reeves, of Bratton, near Westbury, Wilts, for their Liquid-Manure Distributor; invented and improved by Thomas Chandler, of Stockton, Wilts, and manufactured by the exhibitors	£5	90	1	30	0	0

AWARDS.

Description of Implement and Name of Exhibitor.	Prize.	Reference to Catalogue.		
		Stand	Article.	Price.
				£. s. d.
HARROWS.				
To William Williams, of Bedford, and Lawrence Taylor, of Cotton End, near Bedford, for their set of Patent Four-beam Diagonal Iron Harrows for Heavy Land; invented by Samuel Taylor, of Cotton End; improved and manufactured by William Williams, of Bedford	£5	122	3	5 10 0
To William Williams, of Bedford, and Lawrence Taylor, of Cotton End, near Bedford, for their set of Patent Four-beam Diagonal Iron Harrows for Light Land; invented by Samuel Taylor, of Cotton End; improved and manufactured by William Williams, of Bedford	£5	122	2	4 15 0
To Stratton, Hughes and Co., of Bristol, for their improved Norwegian Harrow, with Bodkin and Shafts; invented by George Edward Frere, Esq., of Roydon, and the exhibitors; improved and manufactured by the exhibitors	£5	3	45	16 0 0
SCARIFIERS.				
To Ransomes and May, of Ipswich, for their Biddell's Patent Scarifier with seven wrought-iron tines, No. 2; invented by Arthur Biddell, of Playford; improved and manufactured by the exhibitors	£10	116	50	18 18 0
To Smith and Co., of Stamford, for their improved Cultivator or Grubber; invented by S. Smith, of Northampton; improved and manufactured by the exhibitors . .	£10	95	10	15 0 0
HORSE-HOES.				
To Richard Garrett and Son, of Leiston Works, near Saxmundham, for their patent Horse-Hoe on the flat; invented and manufactured by the exhibitors	£10	81	18	18 0 0
To William Busby, of Newton-le-Willows, for his Horse-Hoe on the Ridge; invented, improved, and manufactured by the exhibitor .	£5	9	12	2 10 0
HORSE-RAKE.				
To Willam Williams, of Bedford, and Lawrence Taylor, of Cotton End, near Bedford, for their Patent Horse-Rake; invented by Samuel Taylor, of Cotton End; improved and manufactured by William Williams, of Bedford	£5	122	6	7 7 0

AWARDS.

Description of Implement and Name of Exhibitor.	Prize.	Reference to Catalogue.				
		Stand.	Article.	Price.		
				£.	*s.*	*d.*
DRAIN-TILE OR PIPE-MACHINES.						
To John Whitehead, of Preston, for his Machine for making any description of Tiles or Pipes; invented and manufactured by the exhibitor	£20	75	1	23	0	0
To Mapplebeck and Lowe, of Birmingham, for their set of Draining Tools; manufactured by the exhibitors	£3	67	54	1	5	0
STEAM-ENGINES.						
To Richard Garrett and Son, of Leiston Works, near Saxmundham, for their Six-horse power Portable Steam-Engine; improved and manufactured by the exhibitors	£50	81	22	250	0	0
To Clayton, Shuttleworth and Co., of Lincoln, for their Seven-horse power Portable Steam-Engine with improved Tubular Boiler; invented, improved, and manufactured by the exhibitors	£25	5	2	209	0	0
STEAMING APPARATUS.						
To William Prockter Stanley, of Peterborough, for his Portable Steam-Generator with Compound Tub and Vegetable Pan; invented, improved, and manufactured by the exhibitors	£5	41	3	15	15	0
THRESHING MACHINES.						
To Richard Garrett and Son, of Leiston Works, near Saxmundham, for their Bolting Threshing Machine for Steam or Horse Power; invented and manufactured by the exhibitors	£25	81	23	61	10	0
CORN-DRESSING MACHINES.						
To Richard Hornsby, of Spittlegate, Grantham, for his registered Corn-dressing Machine; invented, improved, and manufactured by the exhibitor	£10	65	12	13	10	0
To Clayton, Shuttleworth and Co., of Lincoln, for their Grinding Mill for breaking agricultural produce into fine meal; invented, improved, and manufactured by the exhibitors	£10	5	7	40	0	0
To Hurwood and Turner, of St. Peter's Foundry, Ipswich, for their Linseed and Corn Crushing-machine; improved and manufactured by the exhibitors	£5	107	3	10	10	0

AWARDS.

Description of Implement and Name of Exhibitor.	Prize.	Reference to Catalogue.				
		Stand.	Article.	Price.		
				£.	*s.*	*d.*
CHAFF-CUTTING MACHINE.						
To John Cornes, of Barbridge, near Nantwich, for his registered Chaff-cutting Machine with three Knives; invented and manufactured by the exhibitor	£10	78	7	14	0	0
CARTS.						
To William Crosskill, of the Iron Works near Beverley, for his improved One-horse Cart, or Harvest-cart; improved and manufactured by the exhibitor	£10	26	38	13	0	0
HARVEST-CART.						
To William Crosskill, of the Iron Works, near Beverley, for his improved One-horse Cart, or Harvest-cart; improved and manufactured by the exhibitor	£10	26	38	13	0	0
WAGGONS.						
To William Crosskill, of the Iron Works near Beverley, for his Waggon; improved and manufactured by the exhibitor . . .	£10	26	28	29	0	0
HAYMAKER.						
To Smith and Co., of Stamford, for their Patent Double-action Haymaker; invented, improved, and manufactured by the exhibitors	£5	95	1	15	15	0
GORSE-BRUISERS.						
To Barrett, Exall, and Andrewes, of Katesgrove Iron-works, Reading, for their Gorse cutting and bruising Machine; invented and manufactured by the exhibitors . . .	£5	58	9	28	0	0
TURNIP-CUTTING MACHINE.						
To the Executors of the late James Gardner, of Banbury, for their Patent Turnip-cutting Machine, with 26 knives for sheep, and 8 knives for beasts; invented by the late James Gardner, improved and manufactured by the exhibitors	£5	8	2	5	10	0
OIL-CAKE MACHINE.						
To William Newzam Nicholson, of Newark-on-Trent, for his Machine for Breaking Oil-cake for Beasts and Sheep; invented and manufactured by the exhibitor . . .	£5	113	1	3	3	0

AWARDS.

Description of Implement and Name of Exhibitor.	Prize.	Reference to Catalogue.				
		Stand.	Article.	Price.		
				£.	*s.*	*d.*
MISCELLANEOUS.						
To Ransomes and May, of Ipswich, for their Patent Universal Corn and Seed Dropping Machine; invented and manufactured by the exhibitors	Silver Medal.	116	49	28	0	0
To William Busby, of Newton-le-Willows, near Bedale, for his registered Ribbing and Drilling Machine; invented by Rev. William Wharton, of Barningham, near Barnardcastle, and manufactured by the exhibitor .	Silver Medal.	9	10	14	14	0
To Richard Hornsby, of Spittlegate, near Grantham, for his invention of depositing the Manure on the ridge before the Roller, and combining the two principles of the ridge and flat in the same implement .	Silver Medal.	65	4	..		
To Richard Downs, of Ryhall, near Stamford, for his Plough for general purposes, with Subsoil attached to it; invented and manufactured by the exhibitor	Silver Medal.	125	1	6	10	0
To Ransomes and May, of Ipswich, for their Universal Patent Trussed-Beam Iron Plough, marked Y U L; invented by John Clarke, of Long Sutton, improved and manufactured by the exhibitors	Silver Medal.	116	95 96 97 98	6	0	0
To James Hunter, of Kelso, N.B., for his Cart Saddle; invented and manufactured by the exhibitor	Silver Medal.	66	1	1	0	0
To Wedlake and Thompson, of Union Foundry, Hornchurch, near Romford, for their Patent Irrigator; invented by George Coode, of Haydock Park, Lancashire; manufactured by the exhibitors	Silver Medal.	121	1	20	0	0
To Ransomes and May, of Ipswich, for their Digging Fork; invented by J. Sillett, of Kelsale, and manufactured by the exhibitors	Silver Medal.	116	127	0	6	6
To John Whitehead, of Preston, for his registered Churn; manufactured by the exhibitor	Silver Medal.	75	9	4	18	0
To William Crosskill, of the Iron Works near Beverley, for his Portable Farm Railway, Turn-Table, and Waggons; invented, improved, and manufactured by the exhibitor	Silver Medal.	26	46 47 48 49	27 to 35	10 10	0 0
To Charles Burrell, of Thetford, for his Circular-Saw Bench, for making hurdles or gates; invented by Walter Palmer, of Southacre; improved and manufactured by the exhibitor	Silver Medal.	13	9	45	0	0

AWARDS.

Description of Implement and Name of Exhibitor.	Prize.	Reference to Catalogue.				
		Stand.	Article.	Price.		
				£.	s.	d.
To Thomas Scragg, of Calveley, near Tarporley, for his improvements in cutting wires and die-plates, as exhibited in his Single-action Tile-Pipe and Brick-making Machine; invented and improved by the exhibitor, and manufactured by James Hewett, of Calveley	Silver Medal.	39	2	22	0	0

COMMENDATIONS.

To Thomas Scragg, of Calveley, near Tarporley, for his Single-action Tile-Pipe and Brick-making Machine; invented and improved by the exhibitor, and manufactured by James Hewett, of Calveley . . .	Highly commended.	39	2	22	0	0
To Hurwood and Turner, of St. Peter's Foundry, Ipswich, for their Portable Threshing Machine; invented and manufactured by the exhibitors	Commended.	107	2	60	0	0
To Ransomes and May, of Ipswich, for their Universal Patent Trussed-Beam Iron Plough, marked Y U L; invented by John Clarke, of Long Sutton, improved and manufactured by the exhibitors	Commended.	116	95 96 97 98	6	0	0
To Richard Downs, of Ryhall, near Stamford, for his Plough for general purposes, with Subsoil attached to it; invented and manufactured by the exhibitor	Commended.	125	1	6	10	0

Ploughs.—The following is the Judges' Report of the trial of these implements:—

Heavy Land Plough.—"This prize was awarded to Messrs. Williams and Taylor, for their plough, Art. 11. The judges particularly commend this plough, for it was almost the only one that could make decent work when ploughing 9 inches deep, which was the depth first attempted. Owing, however, to the hardness of the ground, the whole were altered to 6 inches, and at that depth it preserved the same superiority."

Light Land Plough.—"The prize for this implement was awarded to Messrs. Howard and Son, for their champion plough. In reference to this prize the judges wish to remark that the land upon which the ploughs were tried was of so hard and stubborn a character, that it was by no means a fair trial for them. They do not wish to infer that the result would have been different, but they are of opinion that many of the ploughs selected for trial, which were of excellent construction and first-rate workmanship, would, under more favourable circumstances, have made very different work."

Plough for General Purposes.—" The prize for this plough was awarded to Mr. W. Ball, for his 'criterion' plough. On both the light and heavy land it came into *very close* competition with the winning ploughs; and for all farms of mixed soils the judges consider this an excellent implement, and one that will render two descriptions of ploughs on the same farm quite unnecessary."

Paring Plough.—"This prize was awarded to Mr. G. Kilby, for a plough invented by Thomas Glover. This plough, for paring old turf, stands unrivalled; and though there are others that answer well on stubble, this, for all purposes, was decidedly the best exhibited."

Draining Ploughs.—" The ploughs exhibited for this prize were either bad in principle, or so hastily and imperfectly constructed as to be entire failures, and the prize was not awarded. That invented and exhibited by Mr. Joseph Paul,* was, on a trial subsequent to the public one, by far the most effective, though it fell far short of a perfect implement. Whether it will ever be made to answer all the purposes for which it is intended it is impossible to say, but the judges are of opinion that Mr. Paul well deserves the thanks of the landlords and his brother farmers for having expended so much time, money, and ingenuity on an implement which, if perfected, will be of such great national utility."

Subsoil Pulverizer.—" This prize was awarded to Mr. Comins, for an implement which performed its work in a very excellent manner; not only doing more execution than any other by fairly entering the soil and thoroughly breaking it up, but it passed through its trial without being in any way broken or injured."

" The judges commended and awarded a medal to a universal plough, exhibited by Messrs. Ransome, which is applicable to all the purposes of a ridge plough, a moulding-up plough, a horse-hoe on the ridge and on the flat, and a broad-share."

" The judges also commended and awarded a medal to a plough for general purposes, with subsoil plough attached, exhibited by Mr. Richard Downs. There is nothing new in the principle of this implement, but it was more successfully

---

* I attended very closely to the working of this implement, and, although it is at present very far from perfect, it is in my opinion the first step in the right direction towards obtaining an implement of sufficient power to cut a deep drain at once.—C. B. CHALLONER.

carried out than they had before seen it, and they consider it the best method of subsoiling, as the treading by the horses after the subsoil plough is by this means obviated."

Drills for General Purposes.—(Judges' Report.) "Mr. Hornsby obtained this prize for his ten-coulter corn, seed, and manure drill. This drill did its work in a very effective manner; a valuable addition has been made to insure a uniform delivery of seed: the slides which regulate the supply from the pigeon-holes all move simultaneously; they are attached to a light bar, which is raised in an exact horizontal position by two small racks and pinions; the feed of every coulter can by this means be increased or diminished at pleasure without even stopping the drill."

Corn-Drills.—"The prize offered for this implement was awarded to Mr. Garrett for his eleven-coulter drill. It has an improved parallel steerage,—a great improvement on the swing principle, as it remains in one position, without being touched, the whole length of a field; and yet at the ends, where a steerage is so important, possesses the most perfect movement. The seed was deposited in good style on very rough ground. Mr. Hornsby had a very good corn-drill, but, having no steerage, it was not considered so generally useful. Mr. Busby, of Newton-le-Willows, had a new implement, a ribbing-drill, to which a medal was awarded, and which promises well to compete with any of its more costly rivals; the working of this implement was quite astonishing, there certainly being nothing in its appearance to recommend it."

Turnip-Drill on the Flat.—"Mr. Hornsby's six-row drill for turnips and manure did its work in a most satisfactory manner. That exhibited by Mr. Garrett also performed well, but the manure was not exactly of the description to test the powers of these drills. Mr. Hornsby's buried the manure the best, and the coulters appear most capable of a large delivery of tillage of a rough description. We accordingly awarded him the prize."

Turnip-Drills on the Ridge.—"Mr. Garrett obtained this prize, and, we think, for the most perfect implement of the description ever produced; a large amount of manure was deposited in front of the fore-rollers, which effectually covered it and again produced a beautifully formed ridge to receive the seed coulters; after which a second pair of concave rollers finished the work in a style most creditable to the maker. The plan of fixing the manure-coulters before the concave rollers having originated with Mr. Hornsby, we also awarded his drill a medal."

Drop-Drills.—"Mr. Garrett was awarded the prize for his drop-drill. It worked with the greatest exactness at the trial depositing any reasonable quantity of manure, covering it beautifully, and then setting the seed over it; the oscillating movement of the tins is so very rapid that we think it not unlikely to get out of order.

Messrs. Ransome and May exhibited and obtained a medal for a new implement,—a corn and seed dropping machine; it plants the seed with the greatest regularity, but the weight is strongly against it, and it appears doubtful whether it can supersede the drill: but in such hands as theirs nothing appears impossible."

Horse Seed-dibblers.—"There being no competition this prize was withheld."

Hand-Dibblers.—"The only machine of this kind tried which did not injure the grain was Dr. Newington's. This drops any quantity of grains, which are thrust into the soil by blunt-ended dibbles. It looks complicated, but is in reality the least so of any, and obtained the prize."

Hand-barrow Drills with Cups, for Ridge-work.—"Mr. Holmes's was the most useful drill under this head, and obtained the prize."

Manure-Distributors.—"Five manure distributors were tried; none of them were quite so perfect in their operations as we could have wished, not sowing small quantities sufficiently even for powerful manures. Mr. Crosskill had the advantage, however, having this year introduced a number of small scrapers to the delivering roller, which could not fail to have the desired effect on the moistest manures. We considered this addition entitled him to the prize, and awarded it accordingly.

Liquid Manure Distributors.—"Mr. Chandler obtained this prize, his being the only machine likely to act effectively with any thick or muddy fluid; the delivery being by two series of endless buckets, the choking or stopping is rendered impossible, as in the ordinary method of perforation. Mr. Stratton's was not so manageable as might be, but may become very useful in the double capacity of water-cart and distributor.* Mr. Coode obtained a medal for certainly a novel invention,—a patent irrigator. In its present form it would require the liquid to be in a strictly limpid state, or its action would be impeded altogether."†

The foregoing remarks of the judges of drills show that the two great rivals in drill-making, Messrs. Garrett and Hornsby, have not been idle since the York Meeting; but that both brought out at Norwich substantial improvements which de-

---

* Mr. Chandler's appeared to me to be the *best* principle we at present know of for the delivery of liquid manure; and I suggested to Messrs. Reeves, the manufacturers, to apply the same principle to a simple and cheap *water cart*, in which case it would be a most valuable implement.—C. B. Challoner.

† It seems more particularly calculated for market gardens, though upon a farm it would possess the advantage of being used without horse-labour, poaching the land, or injuring young crops.—Dudley Pelham.

servedly obtained for their implements the prizes appropriated to their respective classes. These improvements are not of a showy kind, and would be overlooked by a casual observer, but they materially add to the precision with which the seed is deposited, and therefore to the value of a drill. Mr. Hornsby's improved mode of regulating the feed is so fully described by the judges, that any additional remarks would be superfluous; but of Mr. Garrett's parallel steerage it may be as well to mention that it is especially applicable to stetch work where the stetches or lands are narrow. Where, for instance, the stetches just require a single bout of the drill, one wheel is always in the furrow, and the parallel steerage not only enables the drillman to start the coulters exactly in their right places, but keeps them true to their position as respects the crown of the land, without any attention on his part, until the steerage is again called into action when the horses turn at the end of the field. The cause of the superiority possessed by the parallel over the ordinary swing steerage is, that in a drill made on the latter principle the coulters when acted upon by the steerage describe part of a circle, and have a natural tendency to fall to the centre, which is the lowest point. They therefore lie heavy on the hands of the attendant whenever removed from this position, *i. e.*, whenever the steerage is in action. The parallel steerage, on the other hand, moves the coulters in a direct line, so that they have no tendency to any particular point, and remain where they are placed. For stetch work, therefore, this steerage is very superior to anything that has hitherto been brought out. For broad flat work, the fore-carriage steerage previously in use by the Messrs. Garrett, is capable of somewhat greater accuracy; but most farmers would be satisfied with the performance of the drill with parallel steerage, especially when they knew that it was cheaper than the fore-carriage steerage, and required one man less to work it.

In the Implement Report of last year an appeal was made to the implement makers to supply a cheap and simple corn-drill for the use of small farmers. This appeal has been well responded to by Mr. Busby, who brought out at Norwich a drill, on an entirely new principle, the invention of the Rev. W. Wharton, of Barningham, near Greta Bridge, Yorkshire. The working of this drill was, to use the Judge's own words, "quite astonishing, as there was nothing in its appearance to recommend it." It is well known to those who farm strong land, that it is frequently very difficult to make the coulters of an ordinary drill enter the land to a sufficient depth to deposit the seed out of harm's way; and even where a pressbar is able to effect the purpose, the draught of the drill is so much increased that an additional horse is required at a time when the land will ill bear any additional trampling. In such cases the ribbing-plough is frequently had recourse to, nor is there any better method of securing a good plant of wheat: though the slowness of the process and the necessity for sowing the seed by hand are decided drawbacks to this mode of preparing the land. Mr. Busby's implement adopts the mode of opening the seed-furrow which forms the peculiar merit of the ribbing-plough, but combines with it the method of delivering the seed which is usual in corn-drills; so that it promises to be an implement of great utility, especially in those cases where other drills fail. The Judges found fault with the appearance of this implement; this will probably be improved when it next comes before the public: but it is to be hoped that in any extra finishing which Mr. Busby may bestow upon it, he will not lose sight of one of its great merits at present, viz., that it is a *cheap* as well as effective drill for small farmers.

Harrows for Light Land.—(Judges' Report.) "This prize was awarded to Art. 12, stand 122, exhibited by Messrs. Williams and Taylor. For strength of construction and steadiness in working the Judges consider these harrows superior to any others exhibited. With respect to Howard's jointed harrows, they wish to remark that though they would in all probability work exceedingly well under ordinary circumstances, on the hard ground on which they were compelled to try them they worked very unsteadily, pulling up the furrow instead of cutting through it, and consequently leaving the surface very rough."

Harrows for Heavy Land.—"This prize was also awarded to Messrs. Williams and Taylor, for Art. 3, stand 122, for the same reasons as the above."

"Mr. Coleman, stand 32, exhibited a set of expanding lever harrows, which worked exceedingly well; but they are nearly double the price of the above, and more liable to get out of order."

Norwegian Harrows.—"This prize was awarded to Messrs. Stratton. Their Norwegian harrow, after having been closely tried with others on both heavy and light land, performed its work most to the satisfaction of the Judges. It, however, did very little good on the heavy land, and they are of opinion that this implement is not of that general utility which it was expected it would have been."

Scarifiers.—"This prize was awarded to Messrs. Ransome for their Biddell's scarifier, as it was the only one, with the exception of Smith's, of Stamford, that would enter the ground in its then hard state. The Judges consider the *light* scarifiers can never fairly compete with the heavy ones, and that a separate prize should be given for them, as they are, as to price, within the means of the small farmer, and are, in ordinary seasons, very useful implements."

Cultivator, or Grubber.—" This prize was awarded to Messrs. Smith and Co., for their cultivator, Art. 10. It is a very effective implement, either as a scarifier or grubber, both of which operations it is capable of performing in a very efficient manner; and as it is moderate in price, and very strongly made, it was considered fairly entitled to the prize."

Horse-Hoe on the Flat.—" For this prize there was no one to compete with Mr. Garrett's well-known implement, which on this occasion fully sustained its previously well-earned reputation."

Horse Hoe on the Ridge.—" This prize was awarded to Mr. William Busby, for his horse-hoe, Art. 12. This implement is very strong, and well made, and performed its work exceedingly well. Its moderate price also recommends it to the notice of every farmer. The Judges feel bound to notice Mr. Garrett's double ridge hoe, which did its work in a most satisfactory manner; and to those farmers who use a double ridge drill, which it is best adapted to follow, it is a great acquisition. By having additional knives it is convertible into a hoe for corn or root crops on the flat."

" The Judges wish to notice Art. 7, stand 105, a five-tined drill grubber, exhibited by Gray and Sons, as a very strong and well-made implement, and most effective for deep cultivation between the rows of root crops."

Horse-rakes (Judges' Report).—" In this class great improvement had taken place in all the implements, with a few exceptions, where the alterations had been rather in the wrong direction. We selected the following six for trial :—

" Stand 9, art. 19.—Mr. BUSBY's—This rake worked tolerably well.

" Stand 37, art. 25.—Messrs. HOWARD's did not work so well as expected, as it had all the appearance of being the same as the prize implement, but in working had not its merits, although it worked well.

" Stand 64, art. 9.—Messrs. HENSMAN's did its work pretty well.

" Stand 95, art. 4.—SMITH and Co's did its work very well indeed, and stood next in merit to the prize implement.

" Stand 104, art. 2.—Mr. GRANT's did its work in its usual way.

" Stand 122, art. 6.—Mr. WILLIAMS's rake did its work in that way which has so long been desired, the peculiar curve of the teeth causing the hay, corn, or stubble to rise round their face until its own weight caused it to fall over, so that the whole is rolled into a piece like a lady's muff or the roll of wool from a carding-machine, giving the air and wind free circulation through the mass; the same action also allows the stones and lumps of soil to fall between the teeth while the stuff is being pushed round the face of the teeth. The leverage for raising the teeth worked easier than any of the others; so with all these advantages we felt justified in awarding it the prize."

Drain-tile or pipe-machines (Judges' Report).—"There was a considerable falling off in the number of these machines this year, only 24 being exhibited, and the principal part of those appear to remain unimproved, or have not advanced in the same proportion as Whitehead's, Scragg's, and Clayton's: these three machines are much improved; indeed, so nearly balanced were the two former, that it would have been a difficult task to decide between them, had not Amos's machine for testing hand-power been applied: by this very ingenious instrument it was discovered that Whitehead's machine required much less power to work it than Scragg's did, and the prize was accordingly awarded to him. It is well finished; the clay-box has a planed, smooth surface, which very materially reduces the friction on the sides, top, and bottom; the method of closing and fastening the box-lid is also well worthy of remark. In this machine there are two racks, by which the great power required to force out the clay is more distributed; in Scragg's there is only one, and all the strain is on two cogs alone; the fixing the die-plates is most effective and simple; the cutting apparatus is very good; indeed, the machine in all respects is worthy of the prize. Mr. Scragg has made improvements in his cutting apparatus and die-plates, which are very creditable to his ingenuity; and we highly commended his machine, and awarded it a medal.

"Mr. Clayton's machine is still on the combined principle of vertical and horizontal. This maker has displayed a vast deal of patience and ability in the endeavour to perfect an *erroneous system*—not that a horizontal motion will produce pipes of very large bore so perfect as the vertical, but when it is considered how few pipes of this description are required compared with the smaller sorts, it must at once be seen that a machine which requires the cylinders at *all* times to be filled from such an elevation, cannot be economical of labour.

"Franklin's combined plan of pugging, screening, and moulding was shown. The earth was of a description to test its utmost powers; the work was done in good style, but was not expeditious enough to answer.

"The following tabular statement gives the result of five minutes' work of the eight machines selected for trial. Every preparation was made beforehand by the respective exhibitors to ensure the largest delivery in their power within the time specified; any faulty pipes were thrown aside and not counted:"—

Stand.	Art.	Name.	Length of Pipes in Inches.	No. of 2-inch Pipes.	Men.	Boys.	Horse.	Price. £. s.
4	2	Clayton . . .	13½	110	2	1	. .	29 10
7	8	Eaton	13	41	2	. .	. .	20 0
39	2	Scragg . . .	13	134	2	. .	. .	22 0
75	1	Whitehead . .	13½	185	2	1	. .	23 0
81	49	Garrett . . .	14	78	1	1	. .	25 0
94	1	Ainslie . . .	15	40	1	2	. .	35 0
101	1	Franklin . . .	13	24	1	2	1	25 0
122	13	Williams . . .	13	54	1	1	. .	13 13

There were ten less of these machines exhibited at Norwich than at York. All the best machines extant were, however, brought forward, and there was no reason to regret the reduction in numbers. The names of Whitehead, Scragg, and Clayton still appear at the head of the list, and with one or two exceptions their machines are the only ones which call for any particular notice. One of these exceptions is the one invented by Mr. Weller, and exhibited by Messrs. Garrett. This machine undoubtedly made very good tiles at a tolerably rapid rate; and had the principle of construction been as good as the workmanship, it would have been very hard to beat, for, as might be supposed from its being in Messrs. Garrett's hands, it was exceedingly well got up and admirably served. It is, however, impossible for skill and zeal on the part of master and man to enable a machine to compete successfully with those on a decidedly better principle; and there are two weak points in this implement, either of which would be conclusive with the present close competition: one is, that it is worked by lever, a very objectionable mode of applying hand-power; and the other, its having cylinders which require to be placed in a different position for filling to that which they occupy when at work. This necessarily takes up time and complicates the construction, and contrasts unfavourably with the simplicity and substantial character of the fixed clay-box.

The case of Mr. Clayton's machine is somewhat similar, and the duty of a reporter becomes painful when it is necessary to point out objections to an implement upon which great labour and mechanical ingenuity have been perseveringly bestowed, and which when first introduced was a decided improvement upon those which had preceded it. That Mr. Clayton's machine makes excellent work is undeniable, but when it is necessary to decide which is the best principle of construction, it is at once apparent that the numerous clever contrivances by which his shifting cylinders are made as little objectionable as possible, are yet proofs of the faulty nature of the original plan. The first requisite in an agricultural implement is efficiency, the second simplicity, and this last is scarcely less important than the first, inasmuch as simplicity is the very quality which ensures its being efficient in the hands of ordinary unskilled labourers, and at the same time affords the best guarantee for its being rarely out of order, and being easy to repair when an accident does happen. Let the two prize-machines (which may be considered identical in principle) be compared with Clayton's in the two points above mentioned. With respect to *efficiency*, all three make very good tiles, and though the prize-machines are more rapid in their performance, Clayton's is sufficiently expeditious for most tile-yards, and the additional number, though a point in favour of the former, is not one of a decisive character. Under the head of simplicity, however, the case is very different. If a labourer of the most ordinary capacity were once shown how to open and fill Whitehead's clay-box and which way to turn the handle, it is hardly conceivable that he could ever after make a mistake, and the strength and simplicity of construction of the whole machine are such as almost to defy wear and tear. Clayton's machine, however, has several additional movements, and is therefore of necessity more complicated, and when the men who work it have become thoroughly acquainted with its action, there must always be a good deal of nicety and exactness required in stopping at the moment that a length of pipes is complete, and in holding the horse in the right position for receiving the tiles. This only applies to the vertical mode of delivery; but if the horizontal plan be practised, then the height to which the clay must be handed, and the additional labour required in filling small cylinders instead of a large clay-box, besides the extra cost of the machine, will cause an unfavourable comparison to be drawn between it and the prize-implements of Messrs Whitehead and Scragg.

The machine invented by Mr. Ainslie made pipes of better quality than any other in the yard. This excellence of manufacture is attained by the forcible compression of the clay between iron rollers, which gives it a more uniform density, and effectually gets rid of the air-bubbles which more or less blister the tiles made by all other machines. Its high price and the slowness of its action must prevent its coming into common use unless much improved, but it would be valuable to any one who was anxious to make a limited number of tiles of very superior quality, regardless of expense.

Steam-engines (Judges' Report).—"In making our report of the trial of steam-engines at the country meeting of the Royal Agricultural Society held at Norwich, July, 1849, we would remark that the arrangements made by the Society were very judicious, and gave every facility for the application of the force-resister, which has proved so excellent a test of the relative powers of the different engines and machines. And we think great credit also due to the Society's engineer, Mr. Amos, for the very efficient arrangements made by him for ascertaining the real power absorbed for the amount of work performed by each threshing and other machine subjected to this trial.

"In the following remarks we have taken the engines in the order as entered in the Catalogue, and under their respective stands and numbers, for easy reference.

Page 16.—Stand 5, art. 1, 2, 3.

"Three portable steam-engines, manufactured by Messrs. Clayton, Shuttleworth, and Co., the powers of 5, 7, and 9 horses respectively. Two of these engines were of the same construction, the third a two-cylinder engine, which we think an unnecessary complication when designed for agricultural purposes. The three boilers were all tubular, and precisely the same in make, thereby obtaining on the trial an unfair advantage over but one of a kind exhibited by other parties. In saying this, we intend not the slightest reflection upon Messrs. Clayton, Shuttleworth, and Co., but under similar circumstances *we* should recommend in future that but one of a kind should be tested for each exhibitor. The workmanship of these engines was good, the arrangement for working the governors new, and the general performance satisfactory, doing good duty for the fuel consumed, as will be seen by reference to the tabular statement.

The crank-shaft we thought too short between the bearings to remain steady in constant wear; the piston and valve-rods worked through screw stuffing-boxes, which is a method now seldom adopted but for the sake of cheapness; the engines were mounted on iron wheels, which we think not so suitable for farm roads as wooden ones. Having made these observations, we have now the pleasure to add that we felt so well satisfied with the quick generation of steam and duty done by these engines, as to select the 7-horse article, No. 2, for the second prize of twenty-five pounds."

Page 22.—Stand 13, art. 1.

"A 4-horse portable engine, manufactured by Mr. Burrell. This engine in workmanship was moderate: it was fitted with three different speeds, the governors being made adjustable to the same. The duty performed for the coal consumed will be seen to be less than half that of the prize-engines, which sufficiently stamps its comparative merits."

Page 134.—Stand 65, art. 8.

"A 6-horse portable engine, manufactured by Mr. Hornsby.

The workmanship of this engine was good; working parts firm, and strong-fitted; complete; with mercury-gauge, and an additional safety-valve placed out of the control of the engineman, thereby giving greater safety. The boiler was tubular, but formed of two sets of tubes, the one direct, the other returning the smoke from the smoke-box to the chimney placed in front of the boiler. This arrangement caused a great deficiency in the draft, so that combustion of the fuel proceeded very slowly, and consequent upon this, the time used in getting up steam, namely, 92 minutes, was too long to be good in practice, and the effective duty performed by the engine showed a corresponding result."

Page 156.—Stand 81, art. 21.

"A 6-horse patented portable engine, manufactured by the patentees, Messrs. Garrett and Son. The boiler of this engine was formed with two direct side flues and one return circular flue, the chimney being over the fire-box, and was the only flue-boiler exhibited, which makes it interesting to notice, that with a good draft and capability of burning an inferior description of fuel, the duty done was equal to several of the tubular boilers, while the price is less. The workmanship of this engine was good, working parts firm, strong, and well fitted, with mercury and water-gauges and governors well adjusted. The force-pump is fitted with a tap so constructed as to return a portion of water back to the cistern when the boiler is sufficiently supplied, thereby rendering the bursting of the joints through the carelessness of the attendant, impossible. This engine was mounted on strong wooden wheels very suitable to farm roads."

Page 157.—Stand 81, art. 22.

"A 6-horse portable engine, also manufactured by Messrs. Garrett and Son. The general remarks made upon their former engine are also equally applicable to this as respects workmanship and strength; it is also fitted with the necessary steam and water-gauges and governors, and we would especially notice the strength and construction of the one carriage of the *four* bearings of the crank-shaft, admitting of their being bored out at one operation in the lathe. The boiler of this engine is tubular, but the fire-box circular, the outer case being an uniform cylinder throughout, thereby attaining great strength and durability, points so essential to be noticed in engines to be worked by unexperienced hands; the plates of this boiler were $\frac{3}{8}$, and tube-plate $\frac{3}{4}$-inch thick, showing much greater strength than in the one which obtained the second prize. The duty performed by this engine was very satisfactory, as will be seen by refereuce to the tabular statement: and if we make due allowance for a cold rain falling during the whole of *this* trial, the other engines having the advantage of a hot sun, the result will assign to this engine in duty done, as well as in strength and durability, the first prize of fifty pounds, which was awarded accordingly. We would observe in addition, that the driving-wheel of this engine contains a groove for a round band, which cannot be too highly recommended for working threshing-machines, as avoiding the great exactness necessary in placing the machines when working with a flat belt."

Page 161.—Stand 83, art. 1.

"A 6-horse portable engine, manufactured by Messrs. J. and E. Headley. This engine was made with a double cylinder, and had a tube-boiler, workmanship good, but working parts too slight for the power stated; the throttle-valve was placed in the smoke-box, an arrangement which we think bad and inconvenient; 107 minutes were occupied in raising the steam to 45 lbs. pressure, and the duty performed was comparatively small; the result would have been something better had the firing been properly attended to. The exhibitor stated that his engine was better suited to work with coke than coal."

Page 188.—Stand 98, art. 1.

"A 6-horse portable engine, manufactured by Messrs. John Ferrabee and Sons. The general workmanship of this engine was very moderate; cross-head cast instead of wrought-iron; the boiler tubular, but the number of tubes too few, and of insufficient diameter. In work, this engine was unable to sustain the weight on the force-resister at the required speed, consequently there are no tabular results given."

Page 199.—Stand 107, art. 1.

"A 6-horse portable engine, manufactured by Messrs. Hurwood and Turner. The tube-boiler of this engine was too large and heavy for the power stated; the cylinder and starting-gear being placed out of reach from the ground, and was fitted with *two* heavy fly-wheels, which is unnecessary. The workmanship generally below mediocrity, and after three hours consumed in a fruitless effort to get up steam, the trial was abandoned: the exhibitors wishing it recorded that their engine was suited to work with coke in preference to coal."

Page 206.—Stand 116, art. 1.

"A 6-horse portable and locomotive engine, manufactured by Messrs. E. B. Wilson and Co., and exhibited by them in conjunction with Messrs. Ransome and May. This engine, excellent in workmanship, was fitted with two cylinders; its weight for the power very light, and strong in all the working parts; the boiler tubular and beautifully made; but we think such an engine not suited to put into the hands of farmers' engine-men generally, and should doubt its locomotive powers being of much practical benefit as connected with agriculture, entertaining a fear also that accidents might be of frequent occurrence in steaming from farm to farm."

"The duty performed for the coal consumed in this case was below that of the prize-engines, as will be seen on reference to the tabular statement.

"This engine was stated to be better adapted to work with coke than coal.

"The other engines entered in the catalogue were not brought into the trial-yard, with the exception of one by Mr. John Smith, which was withdrawn by the owner without trial."

TABULAR STATEMENT OF RESULTS.							While working up to their Nominal Powers.	
Name.	Stand.	Art.	Nominal Horse power.	Time taken in getting up steam to 45 lbs. pressure.	Coal used in getting up steam.	Wood used in getting up steam.	Lbs. of Coal burnt per hour.	Lbs. of Coal burnt per Horse Power per hour.
				Minutes.	lbs.	lbs.	lbs.	lbs.
Clayton, Shuttleworth, & Co.	5	1	5 Horse.	44	32¼	20	59	11·8
Ditto ditto.	5	2	7 ,,	45	37¾	20	75½	10·78
Ditto ditto.	5	3	9 ,,	37	41¼	20	105	11·66
Burrell	13	1	4½ ,,	57	28¾	20	114½	25·5
Hornsby	65	8	6 ,,	92	46¼	20	85½	14·2
Garrett and Son . . .	81	21	6 ,,	61	59¾	20	84	14
Ditto ditto . . .	81	22	6 ,,	63	73½	20	69	11·5
J. and E. Headley . . .	83	1	4½ ,,	107	44½	20	108	24
E. B. Wilson and Co., and Ransome and May .	116	1	4⅓ ,,	47	29¼	20	61	14

*Threshing-Machines.**—Great pains were taken with the trial of these machines, as it was felt that their importance could hardly be overrated, and yet that no trial of them had hitherto been made which could be considered really satisfactory. A great step in advance was undoubtedly made at York, where for the first time the power required to work each machine was ascertained; but even this important step fell short of the real requirements of the case, as the mode of registering the power was by no means perfect, and the method then adopted was also deficient, from its furnishing no means of judging of the efficiency of the horse-works. A large majority of threshing-machines are necessarily worked by horse-power, so that no statement of their relative merits could be generally satisfactory which

---

* The judges of threshing-machines requested the writer of the report to draw up the account of the trial of these implements, and furnished him with the tables A, B, C, &c., for that purpose.

left the horse-works unnoticed. The importance of this point will appear when the tabular statement (A) comes under consideration. The trial commenced by a general examination of each machine by the judges and consulting engineer, after which a single horse (and in some instances a second) was attached, with a dynamometer, and the empty machine driven at such a rate as, according to the maker's description, would cause the drum to revolve at the requisite speed. After trying a few of the machines it became evident that the specifications furnished by the makers were not accurate, and it was found necessary to count the cogs of all the working parts and calculate the number of seconds in which the horse-wheel should revolve in order to produce the number of revolutions of the drum intended by the exhibitor. It is much to be wished that exhibitors would be strictly accurate in describing their machines, as misstatements not only lead to great waste of time and trouble in conducting the trials, but frequently place a machine in an unfavourable position as respects other competitors. To show the extent to which these inaccuracies are carried, it is only necessary to mention that in the description of one of the machines it was stated that two revolutions of the horse-wheel produced 700 revolutions of the drum, whereas on calculation it was found to produce 1146, so that, had there been no check to the exhibitor's estimate, he would only have had the credit of making his drum revolve 700 times per minute, whilst the dynamometer charged against him the amount of draught re-

Table A.—Showing the Draught of the *Horse* and *Barn Works* of Threshing-Machines when Driven Empty, as indicated by a Draught-Gauge.

1	2	3.	4.	5.	6.	7.	8.	9.	10.
Stand.	Art.	Name.	Horse Power.	Diameter of Horse-Walk.	No. of Revolutions of Horse in 1 minute.	Speed of Horse in Miles per Hour.	Revolutions of Drum.	Draught in Stones Registered by Dynamometer.	Price.
									£. s.
54	19	Sparke	4	21·5	2	1·53	728	26	60 0
36	1	Holmes	6	20	3·15	2·25	1141	48	75 0
51	1	Page	4	18·25	3	1·81	891	20	52 10
107	2	Hurwood	4	21·6	2·45	1·88	830	28	60 0
58	1	Exall	4	22	3·6	2·85	900	24	53 0
13	3	Burrell	4	23	2·5	2·04	950	21·5	50 0
100	8	Ferrabee	4	20	3·1	2·19	895	17·5	60 0
79	1	Cornish	4	19·5	3·5	2·45	912	22·5	48 0
24	1	Blyth	4	22·3	3	2·38	867	24	70 0
44	1	Woods	4	24	2	1·71	1146	44 at least.	65 0
81	23	Garrett	4	22	2·79	2·18	900	37	61 10
65	10	Hornsby	4	23·6	2·6	2·20	900	32	85 0
64	6	Hensman	4	24	2·14	1·83	900	35	53 0
116	9	Ransome	4	20	3·22	2·31	1000	20	68 0
26	54	Crosskill	4	24	2·7	2·33	840	22·5	56 10

quired to produce 1146 revolutions, a rate of speed 62 per cent. above his estimate.

Table A gives various particulars respecting the machines tried with the dynamometer. These for the most part require no remark; but column 9, which gives the draught in stones when the machines were running empty, is well worthy of notice from the great variation in the amount of power required. In one instance it amounted to 48 st. It should be mentioned that this was a six-horse machine, but after making all due allowance on this score its draught when doing no work was far too great. In another instance it will be observed that the draught was 44 st. To assist in forming an opinion respecting the figures in this column it may be mentioned that the average draught of a plough turning a furrow 9 inches by 6 rarely exceeds 24 stone, and on light land (when not too dry) is generally under 20 stone. Yet this is considered a fair amount of work for a pair of horses, and taking 10 to 12 stone as the average draught of each horse, it appears that in no less than four of the machines tried on this occasion, and which professed to be four-horse machines, it required the ordinary pull of three horses at plough to drive them at their proper speed when doing no work. Had these machines acquitted themselves ill when put to work, the fact would scarcely have been worth notice, but it becomes important when we find that they were subsequently proved to be some of the best exhibited. The result then of this first trial was to show that the best threshing-machines now manufactured are still far from perfect, and as the trials proceeded some progress was made in detecting their weak points.

It will have been gathered from the preceding remarks that Table A gives the result of the application of an entirely new test to threshing-machines, one, viz., which registers the amount of force required to drive the machines when empty. Table B records a further attempt to ascertain the proportions in which the amount of draught given in column 9 of Table A should be apportioned between the horse-works and the barn-works of the respective machines. It will be observed that the number of the

Table B.

1.	2.	3.	4.	5.	6.	7.
Stand.	Art.	Name.	Horse Power.	Friction of whole Machine.	Friction of Barn Works.	Friction of Horse Works.
64	6	Hensman	4	2·39	1·38	1·01
107	2	Hurwood	4	1·99	·69	1·30
36	1	Holmes	6	4·02	·97	3·05
81	23	Garrett	4	2·78	2·07	·71
44	1	Woods.	4	2·81	·46	2·35

machines tried is reduced from 16 to 5. This arose from the trial in question being a new suggestion which occurred to the consulting engineer at a period of the proceedings which did not admit of its being extended to more than a very limited number, those being selected which had acquitted themselves the best in the previous trials.

The mode of conducting this trial was as follows:—The machines were driven by steam, and the power registered which was required to drive them empty. This gave the friction* of the barn-works alone, and is recorded in col. 6. The friction of the whole machine (*i. e.*, both horse and barn works) is shown in col. 5, and is in fact identical with col. 9 of Table A, the power being given in stones in one case, but expressed in the equivalent horse-power in the other. The difference between these two (see col. 7) gives the friction of the horse-works. This method does not pretend to absolute accuracy, but it furnishes an approximation which will in the opinion of the reporter do much to improve the construction of these machines. Its importance will be best seen by comparing two machines in which the whole friction was about equal, but where it was due in very different proportions to the barn-works and horse-works respectively. The machines of Messrs. Garrett and Woods furnish an excellent illustration of this point, the whole friction being in these cases 2·78 and 2·81; the friction of the barn-works being, however, 2·07 and ·46; whilst that of the horse-works was ·71 and 2·35. It is not an improbable supposition that both of these makers on their return home might have endeavoured to reduce the draught of their machines, and had the whole friction only been ascertained, they would have had no clue to the particular part which was in fault. If therefore they had both endeavoured to improve their barn-works, the result would probably have been that the former maker would have improved his machine, but the latter made his worse; and if, on the other hand, they had both altered their horse-works, the case would just have been reversed. From the success which attended this first attempt it is probable that the consulting engineer will be prepared at the next meeting to conduct a trial of this kind in a still more complete and satisfactory way; and it is worthy of remark that it is only by some such method as that above described, in which the draught is ascertained of both horse and barn works combined, that an opinion can be safely given respecting the efficiency of the whole machine when set to work in the farmer's stack-yard.

---

* The term "friction," which is used for the sake of brevity, is here intended to represent the whole resistance offered to the acquirement and maintenance of the stated velocity, whether arising from friction, vis inertiæ, or any other retarding cause.

Table C.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Stand.	No.	Name.	Horse Power	Wheat-Sheaves.	Time.	Clean Threshed.	State of Straw.	State of Grain.	Price.
					′ ″				£. s.
5	4	Clayton. . .	6	100	9 23	Nearly clean	A little broken.	A little broken.	40 0
81	23	Garrett . . .	4	100	6 26	Quite clean	Good	Very little broken.	30 0
24	1	Blyth	4	100	8 47	Nearly clean	A little broken.	Not broken.	25 0
116	3	Ransome . .	4	100	8 57	Clean	Broken	Rather broken.	27 10
100	8	Ferrabee . .	4	100	9 14	Not clean	Broken	Broken.	22 0
51	1	Page	4	100	9 8	Clean	Broken	Very little injured.	19 0
58	1	Barrett, Exall & Co.	Had a very light Cast-Iron Concave, which broke.						
54	19	Sparke . . .	4	100	8 58	Nearly clean	A little broken.	Not injured	25 0
36	1	Holmes . . .	6	100	5 34	Clean	A little broken.	*Very* little injured.	28 0
65	10	Hornsby . .	4	100	6 17	Clean	Broken	Not injured	35 0 with 4 whls.
26	54	Crosskill . .	4	100	7 35	Clean	Not broken	*Very much* injured.	23 0 28*l.* with 2 wheels.
13	3	Burrell . . .	4	100	6 47	Most part clean, but bunches not threshed.	A little broken.	Very little injured.	. .
44	1	Woods . . .	4	100	5 52	Clean	Broken	*Very* little injured.	30 0
5	5	Clayton. . .	4	100	6 16	Not threshed	. .	Not injured.	. .
64	6	Hensman . .	4	100	5 23	Not clean	A little broken.	Very little injured.	27 0 with 2 wheels
107	2	Hurwood . .	4	100	6 35	Clean	A little broken.	Very little injured.	27 0 with 2 wheels

Table C gives the performance of all the machines which were adapted for steam power, and the trial was conducted as follows:—Each machine was furnished with 100 sheaves of mown wheat, and the time it took to thresh them, as well as the quality of the work, with regard to clean threshing and the state both of straw and grain, is given in the columns appropriated to those details. The following attempt was made to place all the machines on an equal footing as regarded motive power. Two steam-engines were employed, and a communication established between their boilers, one being used simply to generate steam, the other both for this purpose and to drive the machines. By this arrangement it was anticipated that the supply of steam would be so great that the boiler of the driving machine could be kept constantly supplied with steam of the desired pressure even whilst the machines were at work, and on trial this was found to be the case. At first sight nothing could appear more satisfactory than this trial, as all the machines worked under an equal pressure of steam, and the time they occupied in doing the same quantity of work would seem to be the fairest possible test of their respective powers. The consulting engineer, however, who watched the trial with great care, discovered that though the steam was constantly at the same pressure, some machines were able to obtain a greater quantity of it than others, and that this depended on the size of the driving pully, which varied in different machines, and thus enabled some to obtain, as it were, a greater number of measures of steam than others. This trial, therefore, was not quite conclusive, but it enabled the judges to select seven of the best for further trial, and the following mode of obviating the above-mentioned inequality was adopted:—Two steam-engines were employed as before, and their boilers connected by a pipe, in which was a cock which regulated the supply of steam from the boiler which merely generated steam to that belonging to the driving engine. The working engine moved at equal velocities in all the experiments, consequently the machine requiring least power was the one which worked with steam of the lowest pressure in the second boiler. The plan adopted, therefore, was to record the pressure of steam which was required to drive each machine, as indicated by a pressure gauge (see Table D).

Table D.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Stand.	No.	Name.	Wheat-sheaves.	Clean Threshed.	State of Straw.	State of Corn.	Horse-power required to work the Machine.	Time of threshing 100 Sheaves.	Amount of Power consumed.
								min.	
64	6	Hensman . . .	100	Not threshed	. .	. 1 .	6·00	3·96	23·76
36	1	Holmes . . .	100	Clean.	A little broken.	. 2 .	5·07	5·41	27·42
44	1	Woods. . . .	100	Ditto.	. .	. 3 .	4·26	6·55	27·90
107	2	Hurwood . . .	100	Ditto.	Rather broken.	. 4 .	3·92	6·75	26·46
13	3	Burrell . . .	100	Ditto.	Rather broken.	. 5 .	6·69	5·63	37·66
81	23	Garrett . . .	100	Not a corn found.	Not broken.	. 6 .	7·15	3·43	24·52
65	11	Hornsby . . .	Drum broke.						

Col. 8 gives the actual pressure of steam expressed in its equivalent horse-power; col. 9 gives the time of threshing 100 sheaves of wheat, and multiplying the two together we obtain a result which expresses the comparative expenditure of power in each case; this is given in col. 10. The quality of the work is shown in cols. 5, 6, 7. The numerals in col. 7 refer to the proportion of broken grain found amongst the threshed corn; Hensman's machine, which is marked 1, having the fewest broken grains, the rest following in the order of the respective numbers.

Table E.—Barley. 20 Bundles threshed; each Bundle weighing $20\frac{3}{4}$ lbs.

1.	2.	3.	4.	5	6.	7.	8.	9.	10.
Stand.	No.	Name.	Barley-bundles.	Clean Threshed.	State of Straw.	State of Corn.	Horse-power required to work the Machine.	Time of threshing 20 bundles. min.	Amount of Power consumed.
64	6	Hensman . . .	20	Quite clean.	Much broken	A little injured.	3·70	6·83	25·27
107	2	Hurwood . . .	20	Ditto.	. .	. .	2·54	6 76	17·17
36	1	Holmes . . .	20	Ditto.	. .	. .	3·92	4·80	18·81
81	23	Garrett . . .	20	Not threshed	. .	A little injured.	7·15	2·41	17·23
41	1	Woods . . .	20	Ditto.	. .	Good.	3·00	3·51	10·53
81	23	Garrett . . .	20	Quite clean.	Broken.	A little broken.	5·53	4·28	23·66
41	1	Woods . . .	20	Clean.	. .	. .	2·07	6·85	14·18

Table E records a precisely similar trial to the last, except that 20 bundles of barley, each weighing $20\frac{3}{4}$ lbs., were threshed by each machine, instead of 100 sheaves of wheat. Messrs. Garrett and Woods were, with the steward's consent, allowed a second trial, in consequence of the men who fed their machines having mistaken their instructions, and believed that the object of the trial was to get the corn through in as little time as possible, without reference to the quality of the work. It will be seen that the 20 bundles were threshed in a marvellously short time; it was, however, done in a very slovenly manner, and they were each desired to thresh 20 bundles more, as they could not be allowed the credit due to rapidity of execution if it was attained by sacrificing the goodness of the work.

After a careful comparison of the results of the above-mentioned trials, it was found that Messrs. Garrett's machine was entitled to the prize.

A hand-power threshing-machine was exhibited by Messrs. Barrett and Exall, which was tested by Amos's machine, and found to require a force to work it which was about equal to the power of $3\frac{1}{2}$ men or $\frac{7}{10}$ of a horse.

Steaming apparatus (Judges' Report).—"28 lbs. of coal and 10 lbs. of wood were allowed to each competitor, and they were directed with this quantity of fuel to heat as many gallons of cold water as they were able to 180°. The following table shows the performance of the four which were tried:—

Stand.	Art.	Name.	Time of getting up Steam.	Gallons of Water in Copper.	Gallons added afterwards.	No. of Gallons raised from 60° to 180°.	Price.
			Min.				£. s.
41	3	Stanley . . .	19	40	86	126	15 15
30	2	Robinson . .	23	40	30	70	9 10
29	3	Richmond . .	23	30	58	88	17 0
56	1	Thompson . .	25½	30	63	93	21 10

"The prize was consequently awarded to Mr. Stanley's apparatus. The Judges have to observe, that Mr. Thompson's steamer worked under a disadvantage, as some of its fittings did not arrive at Norwich, but were lost on the railway."

Corn-dressing machines (Judges' Report).—"1st Trial. In this trial the dressing-machines were supplied with the corn and the chaff just as it came from the threshing-machines. Column 5 of the annexed table gives the weight on the lever of Amos's machine, and shows the comparative power required in each case. They were directed to do as much work as they could with 62 turns of the handle :—

Stand.	Art.	Name.	Time.	Weight on Lever.	Length of Crank.	Best Grain.	Tail Corn.	Whites.	Screenings.	Price.
					Inches.	B. p. q.	B. p. q.	Quart.	Quarts.	£. s.
65	12	Hornsby .	62 Turns.	14 lbs. empty, 15 lbs. working.	14	3 3 1	0 2 0	1	4½	13 10
36	36	Holmes. .	,,	15 lbs. empty, 17 lbs. working.	13	2 2 6	1 0 2½	..	1¼	11 11
81	29	Garrett . .	,,	12½ lbs. empty.	Failed to feed itself.					
86	1	Kilby . .	,,	14 lbs. empty, 15 lbs. working.	13	3 3 3	2 2 0 of Tail-corn Screenings, and much good Corn mixed.			14 0
122	14	Williams & Taylor	,,	. .	Failed to feed itself.			..	..	18 0
45	1	Cooch . .	,,	9 lbs. empty, 10 lbs. working.	13	1 3 2	2 0 4 of Tail and Screenings mixed.			16 0
113	11	Nicholson.	,,	11 lbs. empty.	Failed to work properly.					

"2nd Trial. The corn that had passed through the machines was now dressed a second time over ; 6 bushels were allowed to each—

Stand.	Art.	Name.	Time.	Weight on Lever.	Quantity of Grain supplied.	Height of Feeding Box.	
						Feet. In.	Time. Power.
65	12	Hornsby . . .	35 Turns	15 lbs.	6 Bushels	4 9	35 × 15 = 525
45	1	Cooch	..	..	. .	4 11	
			Best Grain came out with inferior,—failed to work satisfactorily.				
86	1	Kilby	63 Turns	15 lbs.	6 Bushels	4 10	63 × 15 = 945

In this trial Kilby's machine made nearly as good a sample as Hornsby's of the best grain, but was unable to divide the refuse in the masterly manner that Hornsby's performed this part of the work. It is worthy of remark, that Hornsby's performed as much work as Kilby's in a better manner, and in little more than half the time. It therefore won with ease."

Grinding-mills (Judges' Report).—"The portable mills for grinding fine meal did not possess much merit, with the exception of Messrs. Clayton and Shuttleworth's, to which we awarded the prize. It both kibbled and ground in superior style to any of the others, grinding barley perfectly well at the rate of 6 bushels per hour without much heating the meal. It was upon the same principle as fixed mill stones usually are, was well got up in point of workmanship, and took little room, so that we considered it a valuable implement, though we are aware that a pair of 2-feet 8-inches millstones can be put up at considerably less cost where the motive-power is fixed, and applicable to several machines for different purposes.

"Mr. Sparke's mill made very good work for a steel mill, grinding at the rate of 3 bushels per hour, and as a cheap implement deserves the attention of small farmers."

Root-Cutters (Judges' Report).—"In this class there was nothing new or worthy of notice, except that there were several machines exhibited that cut both for cattle and sheep by merely reversing the motion of the crank or handle.

"Out of the number we selected four for trial, the result of which we have put in a diagram, showing the quantity of roots cut and the amount of power required to accomplish the work:"—

Exhibitors' Names.	Stand.	Art.	Price.	Weight of Roots Cut.	Comparative Amount of Power required.	OBSERVATIONS.
			£. s.	lbs.	lbs.	
The executors of the late James Gardner.	8	2	5 10	112	910	Did its work admirably, both for cattle and sheep, cutting into pieces ¾ by ½ inch for sheep, and 2¼ by ⅝ for cattle.
Crosskill	26	61	5 0	112	1500	Worked well, cutting both for cattle and sheep; for sheep into pieces 1⅛ inch by ½, and for cattle slices ¾ inch thick.
Gillett	63	3	4 15	112	1568	Cut pieces ¾ by ¼-inch, convex on one side and concave on the other, well adapted for mixing with chaff. Worked well.
Phillips and Co. .	89	2	5 0	112	1664	The same as Gardner's, with the addition of Mr. Phillips's grating for preventing the last slice of the root from passing unslit, which it performs admirably, but at nearly as much expense in power as the whole cutting amounts to, the cutting absorbing 910 lbs. of power, and slitting of the last slice 754 lbs. of power, which is well worthy the consideration of the farmer, as it is possible it may cost more to do a thing than it is worth.

Chaff-Cutters (Judges' Report).—"In this class there was some improvement, but there did not seem to be any principle introduced that was better than Cornes's; although many makers are turning out machines of his sort better got up than he turns out some of his; and if he does not look very active, he will find an awkward competitor in Messrs. Richmond and Chandler.

"We do not approve of the difference generally made between large and small chaff-cutters, inasmuch as they have a narrower box and also one knife less. Narrowing the box gives great additional lever-power to the man or other power employed at the crank; and we see no reason why the narrow width, with three knives, should not be the most efficient and useful plan of making small chaff-machines.

"Eight were selected for trial, and supplied with the barley-straw that had just been threshed, which was very short, soft, awkward stuff to get through the machines; the result is given in the annexed diagrams:"—

Exhibitors' Names.	Stand.	Art.	Price.		Weight of Chaff Cut.	Comparative Amount of Power required.	Observations.
			£.	s.	lbs.	lbs.	
Cornes	78	7	14	0	112	14,126	Did its work well, and had no tendency to choke. Well managed in feeding.
Richmond and Chandler.	29	7	14	0	112	15,740	Worked well without choking, although very badly fed, sometimes too fast and at others too slow; the chaff was cut a little longer than the others, but very even.
Smith and Co. . .	95	12	17	0	112	16,187	Worked well; did not choke; tolerably well fed; would cut a great quantity in a short time.
Stanley	41	14	12	12	112	21,166	Worked well, though very badly fed; it is the same as Cornes's, with some improvements.
Ransome and May .	116	4	21	0	112	26,128	By some means this machine got choked; the quality of chaff cut was good.
Lomax	87	1	9	0	112	30,291	Had an ingenious description of knives, but through bad feeding it was choked.
Garrett and Son . .	81	31	10	10	112	31,291	Cut rather shorter chaff than the rest, but with only two knives it could not compete with three-knived machines.
Crosskill	26	56	18	0	112	44,800	This machine made very rough chaff.

"Another diagram, showing the quantity that each machine would cut per hour, when driven at the rate chosen by the exhibitor as the best for his machine:—

Exhibitors' Names.	Stand.	Art.	Price.		Weight Cut per Hour.	Amount of Power required.	Observations.
			£.	s.	lbs.	lbs.	
Cornes	78	7	14	0	1,470	185,400	Cuts litter into 4-inch lengths, but not fast.
Richmond & Chandler	29	7	14	0	1,560	219,240	Beautifully got up, and strong.
Smith and Co. . .	95	12	17	0	2,040	294,840	Cuts litter into 6-inch lengths at the rate of 5 tons per hour. Price 3*l.* extra when fitted with a litter-cutter.
Stanley	41	14	12	12	1,080	204,000	Cuts litter into 4-inch lengths, but not fast.
Ransome and May . .	116	4	21	0	840	195,960	Does not cut litter.
Lomax	87	1	9	0	420	113,400	Likely to come out well when the feeding-parts are improved.
Garrett and Son . .	8	31	10	10	1,380	385,560	Does not cut litter.
Crosskill	26	56	18	0	660	264,000	We think this ought to be the last of its sor

"All the machines were tried cutting chaff three-eighths of an inch in length, and each exhibitor was allowed to fill his machine until he was satisfied with the feed and speed at which it was driven; the machine was then stopped, and re-started with the register attached that records the power consumed."

Linseed and Corn-Crusher (Judges' Report).—"Of these machines there were many that cut or ground the linseed rather than crushed it. Crushing is better than partially grinding, because when crushed it does not become lumpy, nor burn to the copper so much as when ground. We therefore tried only those that crushed linseed and corn. The result we have recorded in the annexed diagram:"—

Exhibitors' Names.	Stand.	Article.	Price.	Linseed.			Oats.			Total Time for Both.	Total Comparative Amount of Power required.	OBSERVATIONS.
				Quantity Crushed.	Time taken.	Comparative Power required.	Quantity Crushed.	Time taken.	Comparative power required.			
			£. s.	lbs.	M. Sec.	lbs.	lbs.	M. Sec.	lbs.	M. Sec.	lbs.	
Hurwood and Turner.	107	3	10 10	112	35 12	27,456	112	43 52	36,848	79 4	64,304	Made beautiful work, and had a highly improved feeding apparatus.
Stanley . . .	41	6	12 0	112	30 0	24,388	112	47 36	39,984	77 36	64,372	Worked exceedingly well.
Richmond and Chandler.	29	11	6 10	112	61 52	46,400	112	52 32	41,496	114 24	87,896	Pressed the oil out of the seed, and was defective in feeding, but crushed well.
Ferrabee and Son	100	12	8 10	112	69 20	33,680	112	93 20	56,800	162 40	90,480	Pressed the oil very much out of the linseed, which is objectionable.
Garrett and Son	81	35	11 0	112	39 28	33,152	112	78 24	63,856	117 52	97,008	Did its work well.
Ransome and May.	116	31	12 10	112	48 32	40,768	Did not crush Grain.				. .	Did its work well, but defective in feeding.
Stratton and Hughes.	3	54	12 12	.12	62 24	46,800	112	107 20	80,500	169 44	127,300	Pressed the oil very much out of the linseed; work in other respects well done.
Taylor and Dean	96	4	6 15	112	80 0	67,200	112	78 24	65,850	158 24	133,050	The feeding very imperfect, but crushed well.
W. N. Nicholson	113	8	5 0	112	130 40	94,080	Did not crush Grain.				. .	Work very well done, but slow, and expensive in power.
J. C. Grant . .	104	18	6 10	Would not work.			. .	. .	. .	. .	. .	A new machine on a promising principle, and likely to come out well when matured.

"The time recorded is that in which the power of two men would crush 1 cwt. of linseed or oats. The principal things to be considered are cost price, durability, and the power required to perform a given quantity of work. We did not try them with any grain except oats and beans, and finding that none of them would do beans either so well, so fast, or with so little power as a common bean-splitting machine, we have not recorded the result. It will be observed that we have made the diagram show the relative powers of each machine in crushing both linseed and oats; also the total time and power consumed by each machine in crushing 1 cwt. of linseed and 1 cwt. of oats.

"As the power employed and the interest upon the cost price to cover wear and tear, are the expenses incurred in performing the work, the machine that costs the least and absorbs the least power is the machine that will crush the cheapest. Taking these as just data, we have arranged the machines in the diagram according to their merits.

"We entertain a very high opinion of the value of the machine introduced by the Society's consulting Engineer, for testing the various machines which come under the notice of the Judges; discovering, as it does, any waste of power, we think that it will prove of incalculable advantage in driving all the power-devouring machines out of the show-yards, and preventing them from getting into the farm-yards of the kingdom, to the injury both of man and beast."

Carts (Judges' Report).—"In this class of implements we found that great improvement had been made since last year,

"Firstly, in their being made generally upon more simple principles, with less foolish ornamental carving and shaving, by way of forming apertures for dirt to lodge in.

"Secondly, in the bodies of the carts being placed upon the axle without bolstering up, thereby giving greater facility for filling, less alteration of the weight upon the horse's back in ascending and descending hills, and in rough roads less lateral pressure on the wheels, and less jostling of the horse.

"Thirdly, in several of the exhibitors, especially Messrs. Stratton, Hughes, and Co., Mr. Eaton, and Mr. Crosskill, having wheels made upon the principles best calculated to sustain the lateral and perpendicular pressures of the load when in motion, also in being less liable to cut into the land, from the tire of the wheels being perfectly cylindrical, which gives the true rolling motion desired.

"Fourthly, in the power of making a harvest-cart of sufficient dimensions for one horse, by placing a frame upon the body of these low carts. This frame should turn up at both ends at least two feet higher than the wheels, so as to overcome the splitting action of the arch that goes over the wheels (to defend them from the load), and should not be less than 11 feet in length, being made the full width of the wheels, thus gaining sufficient surface to carry a load for one horse without going higher with the load than its own width; there will also be but little liability to upset, and in short distances it will not be requisite to bind the hay or corn with ropes, as the high ends will have the effect of condensing the load by the motion of the cart as it passes over the various inequalities of the field or road.

"Inasmuch as we found all these advantages carried out most in Mr. Crosskill's cart, Stand 26, Article 38, we felt justified in awarding it the prize, not only as the best cart for general purposes, but also as the best harvest-cart, seeing that when the harvest-frame was placed upon this cart, it was only six inches higher than Hannam's harvest-cart (exhibited by Messrs. Stratton, Hughes, and Co.); and the frame being 11 feet long by 6 feet wide, gave sufficient surface to build upon, thus realizing the principal advantages of Hannam's cart, at the small expense of 2*l.* The mode of altering the cart for general purposes into a harvest-cart is also simple and easy. In Hannam's and Morton's (both exhibited by Messrs. Stratton, Hughes, and Co.), the whole body has to be taken off the wheels, and another put on every time a change of work takes place; whereas in Crosskill's the *harvest-frame* only has to be put on or taken off. Lastly, the expense of this frame is but a little more than a third of the price of either Hannam's or Morton's harvest bodies.

"We recommended to Mr. Crosskill to raise the ends of his harvest-frame at least two feet higher than the top of the wheels, for which improvement we thought he would be justified in charging 13 guineas instead of 13*l.* for the complete cart.

"To parties who are in the habit of carting any sort of soft substance, such as road or street scrapings in a wet state, night-soil, &c., we would highly recommend Mr. Stratton's tumbler-cart, Article 18, Stand 3, as truly adapted for scavengers. The body of this cart can be always kept level, whether the horse be ascending or descending a hill, thus preventing any loss of manure or soiling of the street or road. It is also very low, and turns completely over, so that there is no difficulty in either filling or emptying it, whatever be the nature of its contents.

"As a cart exclusively for carting hay and straw, or for harvest work, we recommend Messrs. Stratton, Hughes, and Co.'s improved Hannam's cart, Stand 3, Article 2, and Mr. Eaton's cart, Article 6, Stand 7."

Waggons (Judges' Report).—"In this class, as in that of carts, we found the elevation of the body by bolstering up was greatly done away with; but with regard to the simplifying of their construction, the advance was but very meagre, except by Mr. Crosskill, who seems to have quite stolen a march upon the other exhibitors in simplicity, with its attendant cheapness. We regret that the other makers did not think the waggons worthy of being mounted upon a set of wheels made on the principles best adapted for bearing hard work and running straight forward, and it is to be hoped that this will not be the case another year.

"We highly recommend Mr. Crosskill's break as a great improvement for hilly roads; but where roads are generally level, the extra weight to be carried about would be more expensive than the occasional advantage would be worth. We would also recommend a pole, as used in Yorkshire, this method being superior to double shafts, which are too confining, and expose the horses to a great deal of jostling that with a pole they would avoid. They would also escape the burden of the heavy harness which is required to enable them to carry the weight of the shafts.

"Perhaps we may now be allowed to make a few remarks on the advantage of lightening wheel-carriages for agricultural purposes. We have found that a good cart with wheels 4½ feet high, with hoop-tire 3 inches by ¾ of an inch, will, if properly cared for, last until it has travelled over greatly above 12,000 miles in road and farm work. Now, if we take the cost of a horse at 2*s.* 6*d.* per day, and the carter at 1*s.* (as he will attend to and drive two horses), making 3*s.* 6*d.* altogether, and if we further assume that 20 miles per day is a fair day's work, drawing 1 ton net material, we find that each cwt. costs about 2*d.* per day's journey of 20 miles: so that if we reduced the weight of the cart 1 cwt., we could add that amount to the load without increasing the work of the horse. In this way we should save 2*d.* in every day's work; and, as in 12,000 miles there are 600 days' journeys of 20 miles each, if we multiply the 2*d.* by 600 it gives us 5*l.* as the amount saved before the cart is worn out, for every cwt. by which we can reduce the weight of the cart; and even supposing that some additional repairs might be required in a cart of lighter construction than ordinary, there would still be a considerable balance left in favour of using light carts."

Haymaking Machines (Judges' Report).—"We found that in this class of implements there was practically no competition, as Smith and Co.'s machine, stand 95, article 1, was very superior to any of the others in all its parts and performance of work; in fact, we think it so near perfection that no man need fear buying under the impression that any great improvement will take place in it in future. We regret to say that all the others fall into the shade when brought into competition with it, yet we hope that others will, after another year's application, be able to give Mr. Smith a closer run for the prize."

Gorse-Bruisers (Judges' Report).—"In this class there were only two machines. That made by Mr. Charles Burrell (Stand 13, Article 11) did its work exceedingly well, but slow, viz. at the rate of 3 cwt. per hour. The trial was interrupted by the giving way of the leverage used for pressing the rollers together, in consequence of the owner having imprudently put extra weight on so as to reduce the gorse to a proper state at one operation, which it failed to do, the gorse being too old. With two-year old gorse, however, we think that this machine would accomplish it. Price 25*l.*

" The other machine, made by Messrs. Barrett, Exall, and Andrewes (Stand 58, Article 9), did not perform its work quite so well as Mr. Burrell's, the exhibitors not having used any extra weight of pressure, but it did a much larger quantity, namely, at the rate of nearly 9 cwt. per hour—the power required being, as nearly as we could judge, about that of 3 horses. This machine did its work pretty well, although the gorse was too old, there being a great many old dry twigs which it was impossible, with any reasonable power, to bruise sufficiently; and with two-year old gorse we think it would do its work sufficiently well. It also got through three times as much work as the last-mentioned implement, so that we felt justified in awarding it the prize.

" We are of opinion that a smaller machine than either of the above would be more generally useful, as many farmers have a limited quantity of land that might be profitably employed in growing gorse, but the great expense of a machine for bruising it acts as a barrier to its cultivation, even under favourable circumstances."

Oilcake-breakers (Judges' Report).—" In this class there was great competition. Mr. Hornsby's (Stand 65, Article 14) was a most efficient machine, doing its work exceedingly well, and working easily.

" Mr. Maynard's (Stand 88, Article 3) was a very good machine, having a decided improvement in the means of conveying the motion to the rollers. This also worked exceedingly well.

" Messrs. Ransome and May's (Stand 116, Article 47) is also a capital machine, doing its work exceedingly well.

" Mr. Nicholson's (Stand 113, Article 4) was powerfully made, worked easily and well, and was calculated to do a great quantity of work.

" We decided to try only those machines possessing merit as breakers for both cattle and sheep, considering them best calculated to supply the wants of farmers in general. We accordingly selected seven possessing the greatest merit, one of which was withdrawn, and one—namely, Mr. Hornsby's—was not tried, owing to his being taken up in the field, and not able to attend to its working. This we were sorry for, as we had a high opinion of his machine.

" We have given the result of our trial in the following tabular form :—

Exhibitors' Names.	Stand.	Art.	Price.	Weight of Cake Broken.	Comparative Amount of Power required.	Observations.
			£. s.	lbs.	lbs.	
Barrett, Exall, and Andrewes.	58	24	4 10	112	3,696	Worked well, breaking the cake very well for sheep, but too fine for cattle.
W. N. Nicholson .	113	1	3 3	112	864	Did its work well, both for cattle and sheep, making very little dust.
W. N. Nicholson .	113	3	5 5	112	1,288	Did well, breaking for cattle and sheep, and tolerably well for tillage.
W. N. Nicholson .	113	5	6 6	112	3,696	Did its work well, both for cattle and sheep.
Ransome and May .	116	46	4 4	112	2,688	Broke the cake rather too fine for cattle, but did it beautifully for sheep.

"In these trials we used the large square Marseilles cake, breaking it into pieces, of which the largest were about 2 inches square for cattle, and about 1 inch square for sheep. In the trial recorded above the cake was broken for cattle alone, but we found that it did not take above a fourth more power to break it for sheep, and in the machine, Stand 113, Article 1, the power was but little increased; and as it did its work well, making the smallest amount of dust, and taking a small amount of power, we awarded it the prize as the best machine for breaking cake for cattle and sheep. It was not, however, calculated to break cake for manure, and for that purpose we would recommend either of those noticed above."

*Miscellaneous Department.**

The Judges have not made any report on the miscellaneous

---

* *Portable Farm Railway.* (Stand 26, Articles 46, 47, 48, 49. *Silver Medal.*)

"I have requested Mr. Crosskill (and it would be well if other exhibitors of implements would consider this point) to turn his attention to a method of avoiding the change of load from the cart to the truck, or from the truck to the cart, which is necessary in the present arrangement of this railway. This might be accomplished either by having carts that would run upon the rails as well as upon the land, or by some mechanical contrivance for lifting the bodies of the carts off their field-wheels, and placing them on the rails, and *vice versâ*.

"There are many situations where rail or tram ways might be made use of at the homestead or in the field, with much economy of time and labour, if some such plan were adopted.

Circular-Saw Bench, or Machine for making Hurdles and Gates, as well as Sawing Planks, &c. (Stand 13, Article 9. *Silver Medal.*)

"The consulting engineer considered that, with a little additional cost, this machine might be much improved. A hurdle was completed in twelve minutes in the trial-yard, from a larch-tree in the rough state, when the machine was worked by steam-power, and with practice less time articles which were this year very much reduced both in number and importance, in consequence of specific prizes having been offered for several classes of implements, which on previous occasions were placed in the Miscellaneous Department. The report will, therefore, conclude with the following description of the apparatus frequently referred to in the preceding pages, viz.:—

Amos's Machine for Testing Hand-power, to which the Society's Gold Medal was voted by the Council.—"This machine consists of a fly-wheel, 3 feet 9 inches diameter, with a winch-handle placed in one of the arms and having a radius of 15½ inches. This is fixed on the principal shaft, which is placed in a horizontal position, resting in bearings on cast-iron framing at both ends. A spur-wheel is keyed on this shaft, 14 inches in diameter; and on the boss through which the shaft works a lever is loosely fitted, say 50 inches long, and balanced by a cast-iron weight on the opposite side of the boss, or centre of motion. The lever has a bush or pivot hole through it, at 14 inches from its centre of motion, and a hook at the end for receiving the weights used in testing.

"A second shaft is carried at one end by the bush or pivot hole in the lever last mentioned, having a spur-wheel 14 inches diameter keyed upon it, and is driven by the wheel on the first (or fly-wheel) shaft; while at the other end it rests in a bearing in the iron framing of the machine. It is carried a short distance beyond this bearing, and has a cast-iron drum or rigger, of 31 inches diameter, keyed on its end, for driving the machine to be tested.

"A counter is attached to the first or fly-wheel shaft, and registers the number of revolutions made by the testing machine.

"A pendulum is attached to the framing, and its vibrations indicate the proper velocity. After a little practice, the labourer has no difficulty in timing the revolutions of the machine with the pendulum.

"The whole of the testing machine is mounted on wheels, and moves (upon a temporary railway) to the machine to be tested. The mode of using it is as follows, viz.:—The machine to be tested has a pulley placed upon the spindle, of the same diameter as the circle described by the winch by which the machine is

---

would be necessary. It is adapted for use in woods and plantations, in making fencing and hurdles, and can be worked by horse-power.

"The attention of exhibitors of implements should be drawn to the requirement of a good portable and not expensive arrangement for *sheltering sheep in the field*, and *feeding them under cover*. The arrangements exhibited hitherto are neither sufficiently portable nor low enough in price to be of practical service, nor are they adapted to uneven or hilly ground.

"DUDLEY PELHAM."

usually worked, and motion is given to it by a strap from the pulley on the testing machine.

" The resistance (or the work done) now causes the spur-wheel and one end of the second shaft to be carried upwards, and partially (in an orbicular manner) round the first shaft. By hanging weights on the lever, the wheel and shafts are prevented from rising, and the power applied and work done indicated by the weights employed.

" For instance: If the work done is equal to one man's power, 8½ lbs. will be the weight required on the lever to keep the whole in equilibrium, supposing the standard of a man's power to be 3750 lbs. lifted one foot high per minute.

" A modification of the principle of this machine has long been in use in paper-mills for disengaging the driving machinery of presses."

Moat Hall, Dec. 1849.

XXIX.—*A Lecture on the Anatomy, Physiology, and Pathology of the Organs of Respiration and Circulation; with especial reference to the nature and treatment of Pleuro-pneumonia in the Ox.* By James Beart Simonds, Lecturer on Cattle Pathology in the Royal Veterinary College; Honorary Member of the Royal Agricultural Society, and its Veterinary Inspector; Corresponding Member of the Société Nationale et Centrale de Médecine Vétérinaire, &c.

My Lord,—Pursuing the course which I have heretofore adopted in addressing the members of this Society at their annual *meetings,* I shall not venture to trespass upon your time by a lengthy exordium. To speak of the great and rapidly increasing benefits which arise from these periodic meetings, however inviting the theme is but a work of supererogation, for all are ready to admit, from the prince of royal blood to the humble plebeian, that they exercise an important influence both socially and morally over our rural population, and contribute in no small degree to our national welfare and independence. The subject which has been selected for this lecture is one of considerable importance to the agriculturist, as it relates to 'the Anatomy, Physiology, and Diseases of the Organs of Respiration of Domesticated Animals,' and to an investigation, in particular, of the nature of that destructive malady affecting the Ox tribe, termed Pleuro-pneumonia.

In directing your attention to the general structure and functions of these important parts of the animal organism, it will be necessary, first, to take a somewhat rapid glance at the processes of digestion and assimilation, for the purpose of placing the office of the lungs in a clearer view. The propriety of this course will doubtless be admitted when we state that here are to be traced the various changes which the nutritious part of the food passes through, prior to entering the circulating fluid, the blood, to contribute to the support of the frame. During life the repeated demand for new materials to supply the constant waste of the tissues, which arises from a multiplicity of causes, gives origin to those sensations which are designated *hunger* and *thirst*. The former of these shows the requirement of solid, and the latter of fluid alimentary matters; and they only yield to the proper amount of food and drink being received. Notwithstanding that both the quantity and the quality of the food which is partaken of, will depend on the habits and conformation of each particular animal, still in all it undergoes a successive and similar series of changes before it ministers to the wants of the system. In the mouth it is masticated, or divided by the operation of the teeth into smaller masses, and while this reduction in size is being accomplished, it is mixed with the saliva, a fluid abundantly furnished by the ducts of the contiguous glandular structures. This insalivation of the food produces both a chemical and mechanical effect; by the former the mass is fitted for digestion by the alkaline action of the saliva, and by the latter for deglutition by being rendered soft or pulpy. Thus prepared, the food descends the gullet and enters the stomach, where, uniting with the gastric juice, it is subjected to a second chemical change, in which lactic and hydrochloric acid are chiefly concerned. This process, commonly called the digestive, is effected, as we have seen, by the *succus gastricus;* a fluid which is secreted within the follicles of the stomach, whence it is poured on the reception of alimentary or other matters.

Digestion thus converts the aliment into a *chymous* mass, and portions of this are alternately passed out of the stomach into the intestinal canal, where they are mingled with the hepatic and pancreatic secretions furnished by the liver and pancreas. The result of the commingling of these fluids with the chyme is the speedy separation into its nutritious and non-nutritious parts, to which is given the name of *chylification;* and, like the other changes we have described, this separation is most probably produced by chemical agency.* The chyle thus formed is next precipitated upon the *villous* coat of the intestines, to be absorbed or

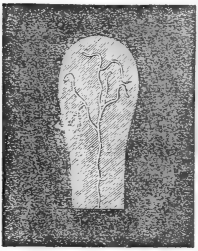
---

* For fuller particulars of these various processes, see 'Lecture on the Digestive Organs,' Society's Journal, vol. ix. part i.

conveyed into the general circulation, while the effete matter is passed onwards in the canal to be expelled from the system.

The vessels which transmit the chyle are designated the lacteals; and as its entrance into them is one of the most interesting and instructive phenomena in the animal economy, we shall describe it somewhat at length. The absorption of chyle taking place in the small intestines, the lacteals are freely distributed here, and consequently a different development of their internal lining membrane exists compared with that of the large intestines. In the former it is thickly studded with shaggy projections, *villi;* hence the name, the villous or velvety tunic. Each *villus* is plentifully supplied with blood-vessels, besides which it contains nerves and the radicles of the lacteal absorbents. The minuteness of these tubes, added to other physical causes, has however prevented their precise arrangement being demonstrated; but it is generally believed that they are formed into loops more or less perfect, as shown in the annexed diagram.* The several component parts of a villus are united together by areolar tissue, and are protected by a scaly epithelial covering. This epithelium is a membrane analogous to the cuticle of the true skin, and is formed after a like manner, and performs a similar office by defending the sensible structures beneath it from injury. By some physiologists the epithelium is supposed to be cast off from the surface of the *villi* during the activity of chylification and absorption, and to be reproduced in the intervals of their suspension; by others however this shedding is not regarded as an essential step in either process. Immediately beneath the epithelial scales lies a great number of cells varying in size from the $\frac{1}{1000}$ to the $\frac{1}{2000}$ of an inch, whose office it is to imbibe the chyle and transmit it to the radicles of the lacteals. The transmission of the chyle to these minute tubes is effected by the bursting or deliquescence of the cells after acquiring their full size; but its entrance into them is due to the law of *endosmose* and *exosmose.* The imbibition, however, of chyle alone by the cells, as they are surrounded by other matters, some of which are even necessary to the well-being of the various organs, shows a power of selection by them, which doubtless is an act of vitality.

Fig. 1.



We cannot now speak of the means provided for a constant development of new cells; but it is right to add a few words on *endosmose* and *exosmose,* and which we prefer to do in the appropriate language of Dr. Carpenter. He says, that "when two fluids

---

[*] From Kirkes and Paget's 'Handbook of Physiology.'

differing in density are separated by a thin animal or vegetable membrane, there is a tendency to mutual admixture through the pores of the membrane; but the less dense fluid will transude with much greater facility than the more dense: and consequently there will be an increase on the side of the denser fluid; whilst very little of this, in comparison, will have passed towards the less dense. When one of the fluids is contained in a sac or cavity, the flow of the other towards it is termed *Endosmose,* or *flow-inwards;* whilst the contrary current is termed *Exosmose,* or *flow-outwards.* Thus, if the cæcum of a fowl filled with syrup or gum-water be tied to the end of a tube, and be immersed in pure water, the latter will penetrate the cæcum by endosmose, and will so increase the volume of its contents as to cause the fluid to rise to a considerable height in the attached tube. On the other hand, a small proportion of the gum or syrup will find its way into the surrounding fluid by exosmose. But if the cæcum were filled with water, and were immersed in a solution of gum or syrup, it would soon be nearly emptied,—the exosmose being much stronger than the endosmose."*

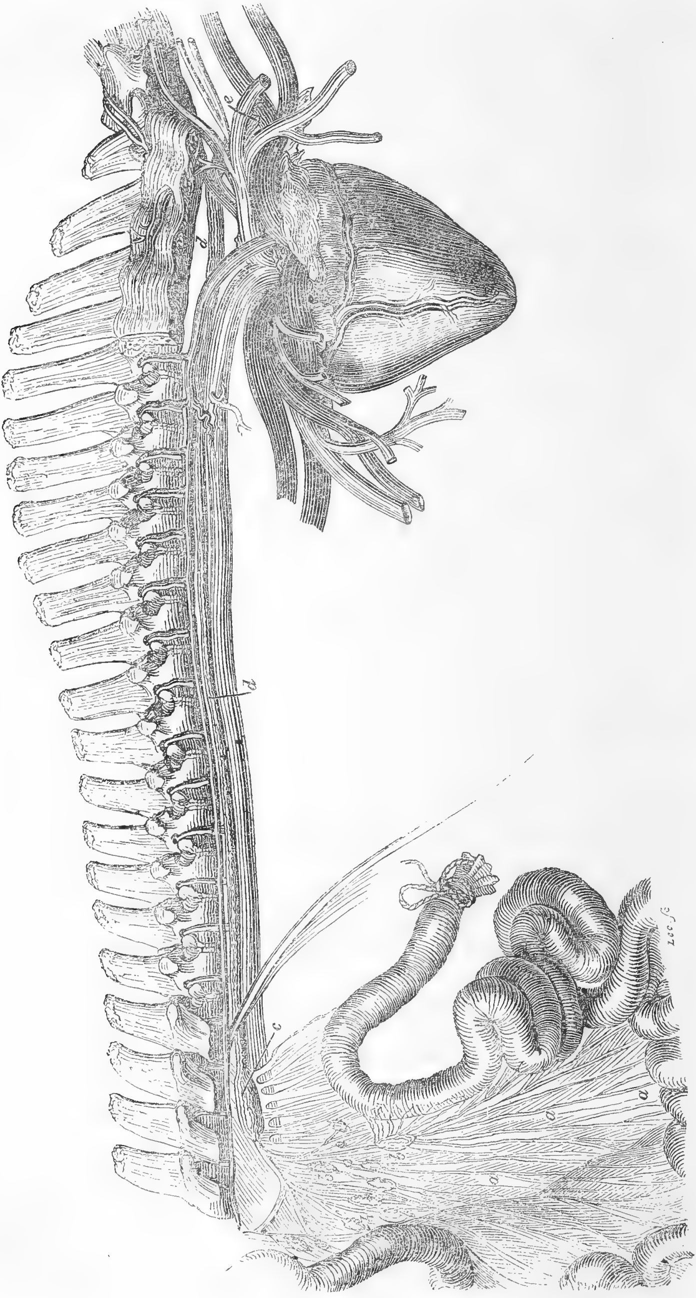
The chyle, by the operation of this law being conveyed into the lacteals, is carried by them into a receptacle marked *c* in fig. 2, situated near to the lumbar vertebræ, and in its course it passes through the mesenteric glands, where it is further elaborated and fitted for its conversion into blood. For the purpose of making this better understood, it is necessary to state that the intestines are attached to the spine, by a double reflection of the serous membrane which lines the abdomen, termed the mesentery, and that the lacteals travel upon this to reach the *receptaculum chyli.* These several parts are depicted in fig. 2, where *the lacteals* are marked *a, the mesenteric glands b,* and *the chyle-receptacle c.*

To enter into a description of the particular changes which are wrought in the chyle by passing through the mesenteric glands would encroach too much on the subject of this lecture, and it will be sufficient to observe that, quitting the glands, it is found to contain a large number of spherical corpuscules, and to possess a power of clotting, like the fibrine of the blood. These corpuscules are formed from the lining membrane of the chyle-conveying tubes; they average in size about the 4600th of an inch, and are probably identical with the white corpuscules of the blood, as these latter are well known to be chiefly concerned in nutrition. The lacteals form frequent unions with each other, by which their size is increased, but their number diminished, so that they ultimately enter the receptacle by a very few trunks. (See fig. 2.) The mesenteric glands are composed of coils of these tubes, ramifying

---

* Carpenter's 'Manual of Physiology,' p. 284.

Fig. 2.



among a minute network of blood-vessels; they are likewise dilated or enlarged within the glands, and make their exit from them in fewer numbers than they entered. Thus the *vasa afferentia* are more numerous than the *vasa efferentia*.

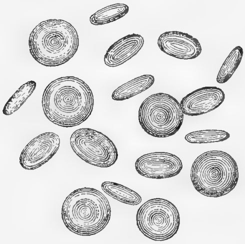
Within the receptacle the chyle unites with the lymph, a fluid which is carried there by the *lymphatic* absorbents which are freely distributed throughout the body. The lymph is chiefly composed of the excess of the materials of the blood which had been exuded by the capillary blood-vessels proper to each organ for its nutrition, and which is thus conveyed back to the general circulation. This fluid in its passage undergoes a series of changes, like the chyle, by traversing the *lymphatic* glands in its course; and the vessels carrying it make frequent unions with each other, so as to end, like the lacteals, in very few trunks. It is thus seen that the supply of new blood takes place from two sources, the chyle and the lymph, and which in health is sufficient to compensate for its continued waste. The contents of the receptaculum chyli are conducted into the circulation through a canal, called the thoracic duct. (See *d*, fig. 2.) This duct passes through the chest (hence its name) very near to the spine, and empties itself into the left jugular or auxiliary vein: in the accompanying sketch it is represented as joining the former at the point marked *e*. The new materials are thus mingled with venous blood, which of itself is unfitted for the support of life until it receives fresh elements of nutrition, and is re-oxygenated by its transmission through the lungs. It is also probable that the chyle and lymph, being almost immediately after their entrance into the circulation exposed to the action of the atmospheric air in the lungs, thus pass through the last stage in the process of converting them into pure blood.

We proceed to speak of the blood, the changes which it undergoes during its circulation, the constituents of which it is composed, and the vessels by which it is conducted throughout the system, as without this we cannot explain the functions of the lungs. Blood may be defined to be a fluid circulating through the heart, arteries, and veins, carrying the materials necessary for the support of vitality, nutrition, and secretion, to every organ of the body;—building up the frame of the young, and supporting that of the old animal. It not only circulates for the purposes of nutrition or renovation, but also to maintain the heat of the frame,—all animals possessing a power of keeping up a heat within themselves, independent of the temperature of the atmosphere they inhabit, be it higher or lower than their own. This is designated animal heat; and its *modus operandi* will hereafter be explained. The heart may be viewed as the central pump from which the system derives the fluid; the arteries the transmitting, and the veins the returning conduits.

In vertebrated animals the blood is of a red colour, but it is colourless in the invertebrated. While circulating it not only appears to be red, but of a homogeneous character; however, on investigating it after being removed from the vessels, it is found to be composed of dissimilar parts. Its chief components are four—fibrine, albumen or serum, corpuscules, and salts; and each of these contributes to the maintenance of the varied functions of the body. The redness of the blood is owing to the presence of red particles or corpuscules, a fact which is demonstrated by their removal, when a colourless fluid, the *liquor sanguinis*, remains behind. Thousands of these bodies exist in a few drops of blood, and consequently they are so minute as to require the aid of the microscope to detect them. It was formerly supposed that the vessels in many parts of the system, of which those of the eye were adduced as an example, did not contain red corpuscules; modern research has, however, disproved this position; and the true explanation of the white appearance of the eye is, that its vessels are so small as not to transmit a sufficient number of these corpuscules at one time, to give colour to the circulating fluid. We have frequent means of ascertaining this, for when inflammation of this organ takes place, these minute vessels are then enlarged, and consequently the red particles, entering in greater numbers, colour the fluid. Hence the cause of the "blood-shot eye."

The microscope, as before stated, is necessary to develop the existence of the red particles, and when thus examined they are found to be flattened discs, of a round form (see fig. 3), varying in size from the 4500th to the 2800th of an inch. We may state their average size as being near to the 3000th of an inch. Bulk of animal seems not to influence their dimensions, and they differ but little in this respect if taken from the elephant or the mouse. As a rule, they may be said to be small in the Herbivorous Mammal, larger in the Carnivorous, and largest in Omnivorous. They are of greater specific gravity than the other constituents of the blood, and hence, when blood is kept in a fluid state, after being drawn, they will be found to sink towards the bottom of the vessel, and thus tend to give that peculiar appearance which is called its buffy coat or inflammatory crust, for the blood in general is longer in clotting when inflammation exists. The red particles are intimately connected with the health, strength, and vigour of an animal; and are found in fewer numbers in ill-health. Wild animals are said to possess

Fig. 3.



These figures represent the blood-discs of the ox, highly magnified, and placed in different positions to show their form.

a greater quantity than domesticated, and those which are fat less than those which are lean. The redness of these corpuscules is due to the presence of a red pigment, *hæmatosin*, which is diffused in the fluid which distends their walls, and it is in consequence of this pigment being chemically acted upon in the minute vessels of the system by the carbonic acid, and in those of the lungs by the oxygen, that the difference in the colour of arterial and venous blood is observed. The change in the colour of the blood is likewise connected with the process which generates animal heat —facts which we shall again advert to.

We pass onwards to speak of the fibrine of the blood. It is generally known that very shortly after the withdrawal of blood it clots or coagulates into a tolerably firm mass; this is owing to its fibrine, and in no way depends on any other of its constituents. This peculiar quality of the fibrine has led to its being called self-coagulating lymph—a term very rarely employed in the present day. It is only by abstracting blood that we are enabled to obtain this material, and to investigate its properties. Various means are had recourse to for this purpose, such as filtering the blood while it is fluid, washing the crassamentum or clot, or stirring the blood while it is undergoing coagulation. The latter is the plan usually adopted; and if a small bundle of twigs are used for the purpose, it will be observed that the fibrine will adhere to them more or less in a colourless condition, leaving behind the serum and red particles.* Washing the mass thus obtained renders it white by removing the colouring matter from the few red particles which were entangled in its meshes while coagulating. An examination of the fibrine shows not only that it is white, but also that it is very tough and elastic, and, when viewed by a magnifying lens, it is found to be made up of fibres which intersect each other in every possible direction. The fibrillating or self-coagulating power of this material serves most important purposes in the animal economy. It forms the temporary bond of union between broken bones, and plugs to arrest the flow of blood from vessels which have been lacerated or torn asunder: and were it not for this, death would frequently result from causes which are now nearly inoperative. Fibrine may justly be described as the basis of the animal machine; and as its appropriation takes place during its circulation through the capillary blood-vessels, and as these form the connecting link between the arteries and the veins, so it will be apparent that venous blood must contain a smaller portion of it than the arterial. The relative quantity in these vessels is calculated by Müller to be in the proportion of 29 to 24. In health, about 3 parts of

---

* Some fibrine thus obtained was exhibited at the lecture.

fibrine exist in every 1000 of blood; but it becomes increased in inflammatory affections, and often rises to 8 or 10 parts in the same quantity. This fact explains why a larger amount of blood can be abstracted during the acute stage of inflammation than in health, without the system suffering to an equal extent.

We pass on to consider the serum. After the coagulum of blood has stood at rest for a short time, a fluid of a pale straw-colour appears on its surface: this is the serum. The separation of the serum from the clot is due to the contraction of the fibrine, which continues long after the blood has coagulated. The fluid therefore is forcibly expelled; being, prior to its separation, mechanically retained in the coagulum, as water may be said to be in a sponge. Serum holds in solution the albumen and salts of the blood, and it is chiefly composed of these matters with the addition of water. Its viscosity will depend on the relative amount of albumen, which in health has been estimated at about 8 per cent. An alteration in the specific gravity of serum will likewise indicate the proportion of its albumen; as in healthy subjects its specific gravity is about 1030. Under disease, and more especially when of a debilitating nature, such as dropsy, the watery parts of the serum are increased, and become effused into various cavities of the body, as the chest, abdomen, or ventricles of the brain. Ordinary serum is also quickly transuded through the thin coats of the capillary vessels, of which we have daily proofs in local inflammation of the external structures, where the swelling is referable to that cause. Unlike fibrine, serum, whether in or out of the body, remains fluid; but as it contains albumen, this is capable of being solidified by heat, and likewise by the admixture of mineral acids, or alcohol.* The heat required to accomplish this is 162° of Fahrenheit—a temperature the body never attains to. Albumen is believed to be converted into fibrine, and thus to minister to nutrition; and it is also thought that the white corpuscules of the blood, of which the limits of this lecture will not allow of a further mention, are the agents which effect the conversion. The salts can be only incidentally alluded to; they amount to between 6 and 7 parts in 1000, and are chiefly composed of the chlorides of sodium and potassium, and the phosphates of lime, magnesia, and soda.

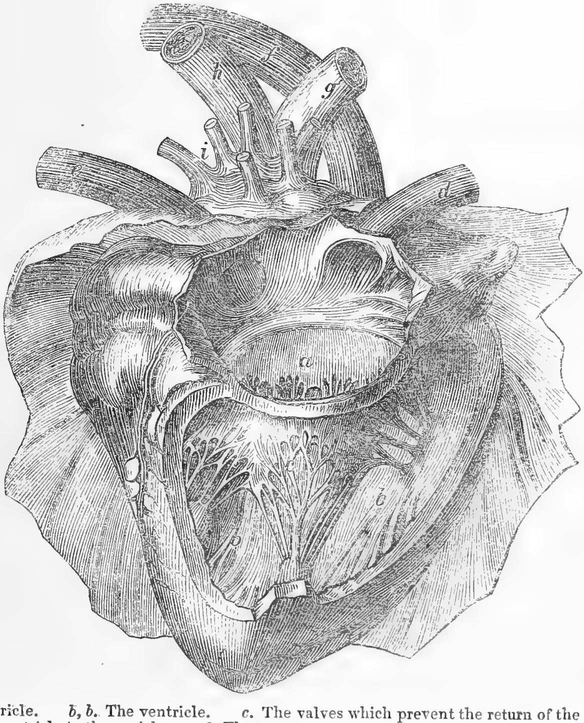
Having now described the constituents of the blood, we pass on to explain its circulation, and the changes which take place during its passage from one part of the system to another. We have before likened the heart to a central pump, as it is by the contraction of the muscular walls of this organ that the blood is

---

* The solidification of the albumen of serum was demonstrated in the lecture by the employment of hydrochloric acid.

driven into the arteries, that arise from two of its cavities, to be conveyed throughout the body. The heart is a double organ, and usually described as having two sides, a right and left. It is also divided into four cavities; the right auricle and ventricle, and the left auricle and ventricle. The two auricles, and also the ventricles, are separated from each other by a muscular partition, so that the right side has no direct communication with the left. In the accompanying sketch, fig. 4, the cavities of the right side are laid open to illustrate the course of the blood. The two venæ cavæ, marked *d* and *e*, receive the blood from the veins of the system which unite to form these vessels, and they empty themselves into *a*, the auricle. From this cavity, by the contraction of its muscular sides, the blood is driven into *b*, the ventricle. The filling of this second cavity leads likewise to the contraction of its walls, by which the blood is propelled into *f*, the pulmonary artery; as the rising of the valve *c* prevents the blood passing back into the auricle by closing the auriculo-ventricular opening.

Fig. 4.



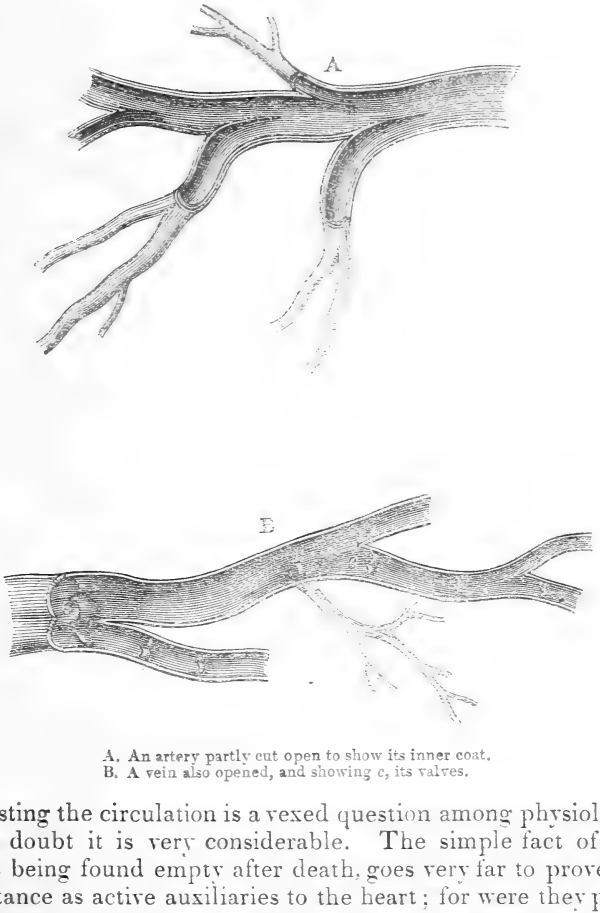
a. The auricle. *b, b*. The ventricle. *c*. The valves which prevent the return of the blood from the ventricle to the auricle. *d*. The anterior vena cava. *e*. The posterior cava. *f*. The pulmonary artery. *g*. The anterior aorta. *h*. The posterior aorta. *i*. The pulmonary veins.

This valve is called the *valvula tricuspis*, being divided into three portions, each of which tends from its base which is attached to the sides of the ventricle towards a loose or floating apex. From the pulmonary artery the blood enters the capillaries of the lungs, where it undergoes a peculiar change, hereafter to be explained, and is thence conducted back again to the heart by the pulmonary veins. The action of the artery in assisting the onward course of the blood would drive a portion of it into the ventricle, but this is prevented by three valves of a semilunar form which guard the mouth of the vessel. The pulmonary veins, *i*, empty themselves into the left auricle, and this into the left ventricle; a similar valve to that of the right side, the *valvula bicuspis*, preventing any retrograde motion of the fluid into the auricle. From the left ventricle the blood passes into the aorta, which, bifurcating into *g*, the anterior, and *h*, the posterior aorta, conducts it through the medium of the arteries branching off from these vessels to all parts of the body. Semilunar valves are also placed at the origin of the aorta from the heart, and serve a like purpose to those existing in the pulmonary artery. The arteries of the system in their course give off many branches, all of which end in hair-like vessels, *capillaries* (see figs. 6 and 7), by which the blood is appropriated to the maintenance of the several tissues; here it likewise undergoes a chemical change (which we shall presently describe), and is afterwards returned to the heart by the veins which unite and form the two cavæ before spoken of. This circulation of the blood is divided into *the pulmonic*, or that which conveys it from the right to the left side of the heart through the lungs, and *the systemic*, or that which takes it from the left to the right side, through the arteries and veins of the system. The contraction of each auricle is simultaneous, and precedes a little that of the ventricles, which likewise contract together. This action of the heart produces the pulse, and the number of its pulsations within a given time materially assists the surgeon in arriving at a correct diagnosis when an animal is suffering from disease.

Having explained "the general round of circulation," we shall add some further remarks on the arteries and veins, and afterwards speak of the chemical changes of blood. These vessels are represented in fig. 5, the artery being marked A, and the vein B: it will also be seen that their inner structure is exposed by a section being carried through their coats.

It has already been stated that the arteries arising from the heart are two, namely, the aorta and the pulmonary, and that valves are placed at their origin to prevent a retrograde movement of the blood; from which it will be inferred that these vessels are not mere passive conduits for the fluid. The amount of their action

Fig. 5.

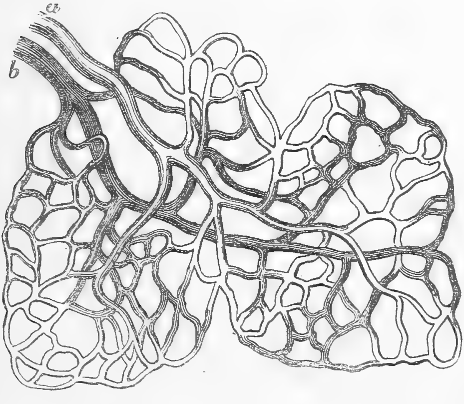


A. An artery partly cut open to show its inner coat.
B. A vein also opened, and showing *c*, its valves.

in assisting the circulation is a vexed question among physiologists, but no doubt it is very considerable. The simple fact of these vessels being found empty after death, goes very far to prove their importance as active auxiliaries to the heart; for were they passive tubes merely, they would then be in the opposite condition, viz., full. The early anatomists were acquainted with the circumstance of these vessels being void of blood after death, and consequently they were led to suppose that the 'animal spirits, being of an aëriform nature,' were conveyed by them; hence the name *artery*, or air-carrying tube. At their origin these vessels are large, but they gradually decrease in size as they proceed from the heart, which is produced in part by the number of the branches they give off in their course. It has been rightly said that the capacity of the arterial system is rather increased than diminished by this subdivision, and therefore no mechanical obstruction from that cause can interfere with the flow of the blood in the small arteries. The rapid splitting up of these vessels into smaller ones is in proportion to the nearness of the organ they are going to, and in every part, as before stated, they end in tubes so minute as to be named capillaries. As the blood which traverses the arteries is destined to supply the system with the materials necessary for the support of life and development, so do we find that they usually take the most direct course to each particular organ. They also run in parts which are most protected from injury, such as the inner side of limbs and bend of joints. Occasionally also they gain security by passing through canals formed in bones—a fact which can be demonstrated in the skull and the feet of several of our domesticated animals. In number the arteries are considerably less than veins, it being necessary that due provision for the return of blood should be made to balance the circulation, as from the situation of veins the current through them is frequently obstructed. The section of an artery (see fig. 5) shows that its inner coat, which is an epithelial membrane, is, unlike that of a vein, perfectly smooth. Besides this coat, these vessels have four others—a serous, a muscular, an elastic, and a cellular. These tunics are not of equal thickness throughout the course of the artery; and especially do we find that the elastic is increased in substance the nearer the vessel approaches the heart; but, on the contrary, that the muscular is most developed at a distance from that organ. The elastic coat gives strength to the vessel, and yields to the distending force of the blood at each stroke of the heart; but as soon as the volume of the blood has passed, it returns by its inherent property to its former condition. The expansion and recoil of the elastic coat converts these jets of blood into a continuous stream; but this stream is still augmented in volume at each contraction of the heart. Hence we observe that, when an artery is divided, the flow of blood from its cut end is alternately increased both in quantity and force, synchronously with the heart's action. Under these circumstances we likewise perceive that the vessel rises in its bed with a peculiar vermiform action, which proves that the elastic coat is not simply distended, but also elongated by the passing current. The elongation is always greater than the expansion, and the two actions combined produce the arterial pulse. Thus we feel the pulse of the artery when its calibre and length are increasing, and that of the heart when its ventricular cavities are contracting. In the language of the anatomist, the heart is in a state of *systole*, and the artery of *diastole*, during their respective pulsations. It is not to be inferred from the foregoing remarks that the elastic coat exerts any propulsive power on the passage of the blood, as this can only be effected by lessening the area of the arterial tube, and must consequently depend on its muscular or contractile coat. It is right that I should state that the muscularity of arteries, although strongly insisted upon by the immortal John Hunter, has since his time not been generally admitted. I could adduce a multiplicity of facts, were it necessary, to prove the correctness of Hunter's views, but content myself by stating that I am of the number of his disciples.*

As the arteries everywhere terminate in capillaries, so do we find that the veins arise from them. A vein (see B, fig. 5) differs materially from an artery, first in the thickness of its coats, and secondly in having its internal lining thrown into folds here and there, forming thereby its valves, marked *c*, fig. 5. These valves perform the office of such structures in general, namely, that of allowing a fluid to pass but in one direction; and as their free edges are directed towards the heart, it follows that they prevent any retrograde motion in the blood by rising and closing the canal. This arrangement is rendered the more necessary in consequence of veins not exerting any power *per se* in the return of the blood, this being chiefly effected by their being pressed upon by the various muscular movements of the body. Veins are also non-pulsatory, and the stream of the blood through them is continuous and even. They are far more numerous than arteries, and are divisible into a superficial and deep-seated set, which freely communicate by anastomosing branches. They likewise increase in size, but diminish in number as they approach the heart, near to which those of the system ultimately terminate in the two cavæ. The blood which they carry is dark in colour, unlike that of the arteries, in which vessels it is of a scarlet hue. This change in the colour of the fluid is produced in the capillaries; the cause and the consequence of which we shall now consider. Fig. 6

Fig. 6.



Capillaries of fat. *a*. The terminal artery. *b*. The primitive vein.
(From Todd and Bowman's 'Physiological Anatomy.')

---

* Since this lecture was delivered, an opportunity has been afforded the author, by the death of the rhinoceros in the gardens of the Zoological Society, of confirming these opinions. He examined a portion of the carotid artery, and found its muscular coat extensively developed. The fibres were arranged more or less in a circular order.

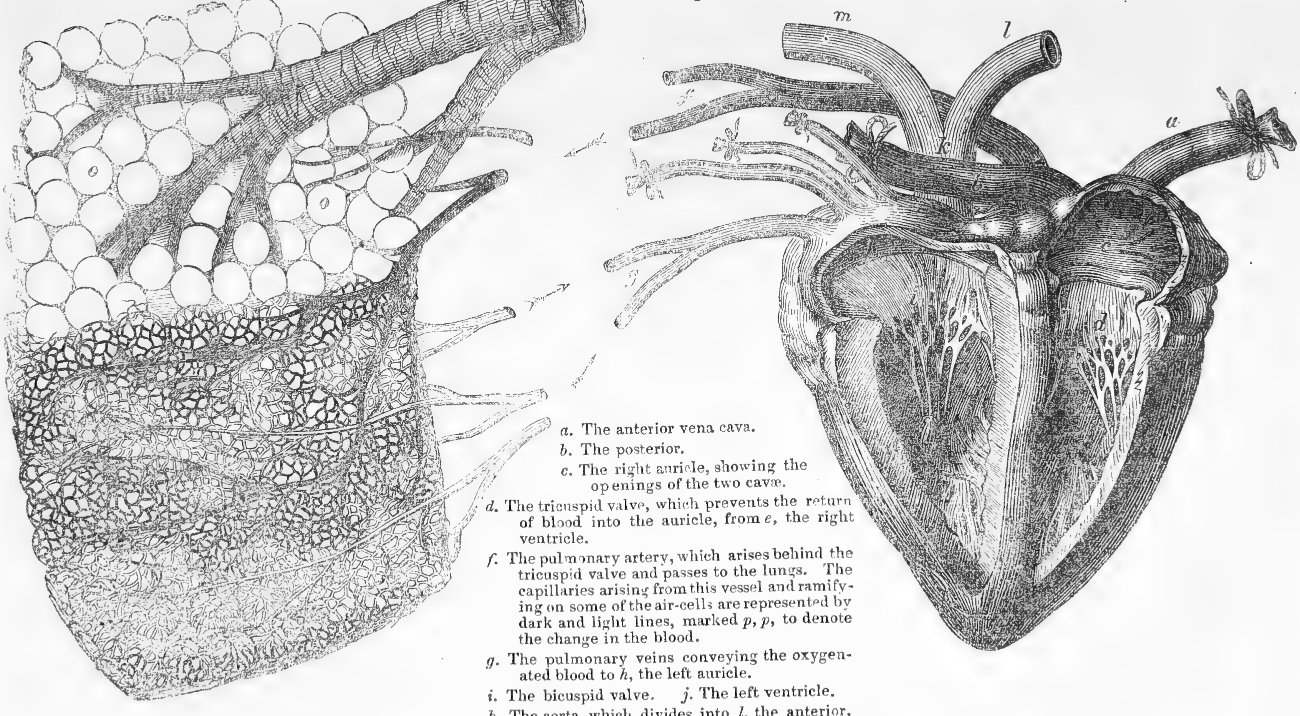
shows an artery, *a*, terminating in a capillary rete of vessels, and a vein, *b*, arising therefrom; it will also be observed that, in accordance with the facts we have described, the former is represented light, and the latter dark in colour.

The brightness of the arterial blood is due to the presence of the oxygen of the air acting on its coloured corpuscules, and which it receives by its passage through the lungs; and the darkness of the venous blood, to the influence of the carbonic acid of the system on the same bodies. These gases, however, affect only the pigment of the red corpuscules to produce this altered appearance of the circulating fluid; and consequently the corpuscules can only be viewed as the indirect carriers of the oxygen into, and the carbonic acid out of the body.

I have before stated that the various tissues of the frame are undergoing a continual waste or change, and therefore they need a constant reparation, which is provided for by the appropriation of the blood by the capillaries. The thinness of the walls of these vessels allows of a transudation of the liquid fibrine, which being imbibed by the surrounding structures administers to their support; while any excess is carried back into the circulation by the lymphatic absorbents. The metamorphosis, however, of the tissues furnishes both carbon and hydrogen, and with these the oxygen, which has been conveyed into the capillaries by the red corpuscules, unites, forming thereby carbonic acid and watery vapour. In this process heat is evolved; and as it takes place in every part of the system, so it follows that the temperature of the body is everywhere kept up to its standard, viz., about 99° of Fahrenheit, independent of external causes. An animal may thus be said to carry with him a self-supplying furnace, which continues in active operation so long as health and vigour of constitution remain. It is this generation of heat by chemical union which is designated animal heat. By the loss of some of its fibrine, and by the presence of carbonic acid, the blood is now rendered unfit for the purposes of life, and in this condition it returns to the heart by the veins (see fig. 6). Near to this organ it receives a fresh supply of nutritive matter through the medium of the thoracic duct (see fig. 2), and passing from the heart to the lungs it again obtains the required oxygen, and parts with the carbonic acid and watery vapour (see fig. 7).

The function thus performed by the lungs, of which we must speak more at length, will be better understood by again referring to the diagram, fig. 7. One portion of this diagram represents the four cavities of the heart laid open, and the vessels which are going to and from them; and the other a branch of the windpipe terminating in the air-cells of the lungs, which are surrounded by a network of capillaries indicating the change in the colour of the blood. The intervening arrows show the course of the blood to

Fig. 7.



a. The anterior vena cava.

b. The posterior.

c. The right auricle, showing the openings of the two cavæ.

d. The tricuspid valve, which prevents the return of blood into the auricle, from *e*, the right ventricle.

f. The pulmonary artery, which arises behind the tricuspid valve and passes to the lungs. The capillaries arising from this vessel and ramifying on some of the air-cells are represented by dark and light lines, marked *p*, *p*, to denote the change in the blood.

g. The pulmonary veins conveying the oxygenated blood to *h*, the left auricle.

i. The bicuspid valve. *j.* The left ventricle.

k. The aorta, which divides into *l*, the anterior, and *m*, the posterior aorta, to conduct the blood throughout the body.

n. A bronchial tube, surrounded by *o*, the air-cells of the lungs.

and from the lungs to the heart. The atmospheric air which enters the lungs at each inspiration through the medium of the windpipe, contains by weight 77 parts of nitrogen and 23 of oxygen; but the expired air is deficient of oxygen, its place being supplied by carbonic acid gas.* An interchange of the oxygen of the air and the carbonic acid of the system is thus effected, these gases displacing each other by permeating the thin walls of the capillaries, which are everywhere spread out as a minute network on the surface of the air-cells. The immediate result of this change is the conversion of the blood from a dark Modena red to a bright scarlet colour, and the fitting of it again for the chief purposes of life.† Thus we see that the blood in circulating through the system becomes unsuited to life, and that it is re-invigorated by its passage through the lungs. The function of respiration is therefore no less important than that of circulation. Many operations of the animal system may be suspended for a considerable time with but little ill consequence, but respiration must be continued, or life quickly ceases. It is true that respiration may be increased or diminished even at pleasure, but it cannot be altogether arrested; for if we attempt to hold the breath for a long time, we experience so much inconvenience, that irresistibly we are compelled to resume the act of breathing. This without doubt depends on the circumstance that during its suspension there is an accumulation of carbonic acid in the system, the continuance of which would produce asphyxia or suffocation. We have here another proof of the wisdom and design of the omnipotent Creator in making respiration, like the circulation, independent of our will.

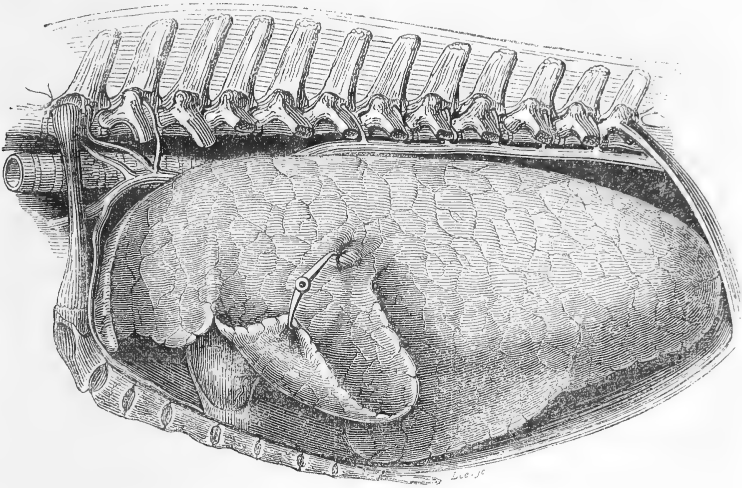
As the circulation has its central organ, the heart, so has respiration—namely, the lungs: and both these are situated within the same cavity, where they are secure from external injury or impediment to their function. We may in this place observe that the osseous portion of the body of an animal forms three important cavities: an anterior, called the skull, which contains the brain and the nerves of special sense; a middle, the thorax, in which is lodged the heart and lungs (see fig. 8); and a posterior, the pelvis, holding the uterus and its appendages, the chief of the female organs of generation. The thorax, however, is constructed on a different plan from the other cavities, for there is an all-important necessity that its area should be capable of being enlarged and diminished, in accordance with the altered volume of the lungs during respira-

---

* This fact was illustrated by breathing into some pellucid lime-water, by which it was rendered turbid; the carbonic acid uniting with the lime, and forming thereby an insoluble carbonate of lime.

† The experiment of pouring some dark, or carbonized, blood into a vessel of oxygen gas was introduced, and immediately it became of a bright red colour.

Fig. 8.



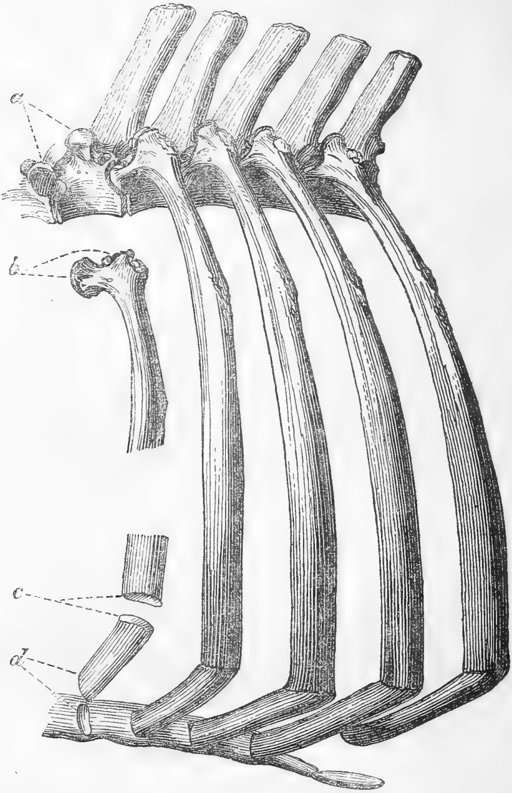
Represents the heart and left lung *in situ*, the side of the chest being cut away.

tion. Such not being needed in the skull or pelvis, the bones forming these cavities are firmly and immovably united together. The thorax is bounded above by the spine, on the sides by the ribs, below by the breast-bone or *sternum*, and behind by the *diaphragm;* a muscular tendinous partition separating it from the abdomen.

The form of the thorax is that of a truncated cone placed horizontally, having its apex formed by the near approximation and shortness of the first pair of ribs, and its base by the diaphragm. The dimensions of the cavity are consequently increased from before backwards; while the hinder part, or base of the cone, is cut off obliquely from above downwards and forwards. The first pair of ribs are situated nearly perpendicular; and more especially in the ox, where they form a right angle with the spine. One of these is represented *in situ* in fig 8. The ribs of the horse number eighteen on either side, but in the ox and sheep they are only thirteen. They increase in length from the first to the eighth, and likewise in their curve obliquely backwards from the spine, from the first to the thirteenth; but they gradually diminish in length from the eighth to the last. Their interspaces are filled up by muscular fibres, the *intercostal* muscles, which are active agents in inspiration. The ribs therefore with the diaphragm form the moveable boundaries of the chest; the spine and the sternum being more or less the fixed points from which they act.

As seen in the annexed figure, No. 9, the ribs are united to the spine above by moveable joints, and to the sternum below by means of their cartilages. The inferior attachment is not, however, in all of them directly to the sternum, some being joined by their cartilages to each other, and thus indirectly to that bone; hence their division into *sternal,* or true, and *asternal,* or false ribs. [In the sketch the hindermost rib is a false one.] Each rib articulates by its rounded head and tubercle, marked *b,* with corresponding hollows in the vertebræ, marked *a,* forming the moveable joints alluded to: these distinct articulations by the head and tubercle are, however, less perfect as we proceed from before backwards. That every facility may be given to the movements of the chest while the ox is recumbent—a position, as is well known, he frequently assumes during rumination—the attachment of the ribs to the sternum, as well as the development of that bone, differ considerably from the horse. These peculiarities, which we are about to

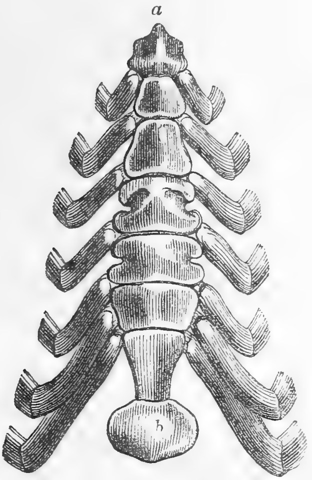
Fig. 9.



a. The cavities in the vertebra which receive *b.* The head and tubercle of the rib. *c.* The surfaces of the synovial joint uniting the rib to the cartilage. *d.* The joint formed by the cartilage and sternum.

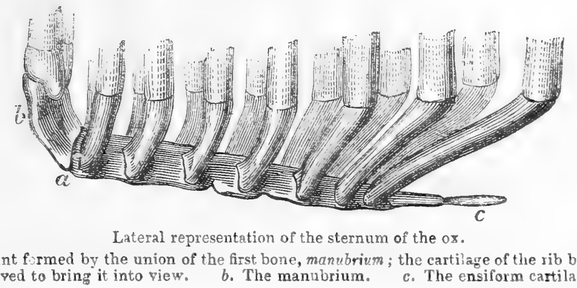
describe, will be at once recognised by a reference to the annexed figures 10 to 13. In the first-named figure the under surface of the sternum of the ox is depicted, and it will be observed that it is perfectly flat, consequently it can be subjected to pressure without inconvenience to the animal when he is resting on the ground. On the contrary, this part of the sternum of the horse has a thin cartilaginous edge, similar in appearance as well as in position to the keel of a boat, see fig. 12, which ill adapts it to receive a similar pressure. In both animals the sternum is originally composed of several bony pieces, which as age advances are more or less perfectly united together: these pieces are, however, very differently arranged, so that in the ox *bone* supplies the place of cartilage in the horse, and forms the flat surface before mentioned. The loss of elasticity, and consequently of motion, cartilage being highly elastic, is however more than compensated for by the manner the first bone is united to the second in the ox. In this animal, the first bone, *manubrium*, is attached by a synovial joint, which allows of a free motion in various directions, but more particularly from side to side; see *a*, fig. 11. The cariniform cartilage in the horse (*a*, fig. 12) is substituted for the manubrium with its synovial joint. The arrangement here spoken of allows the anterior portion of the thorax of the ox to yield the more readily to the respiratory movements, and likewise facilitates the curving of the lower

Fig. 10.



Sternum of ox, inferior view. *a*. The manubrium. *b*. The ensiform cartilage.

Fig. 11.

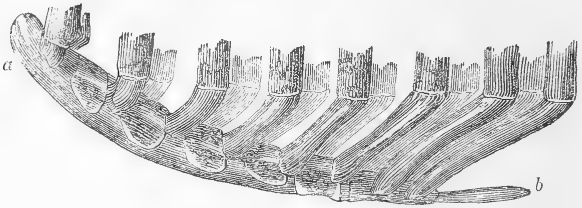


Lateral representation of the sternum of the ox.

a. The joint formed by the union of the first bone, *manubrium*; the cartilage of the rib being partly removed to bring it into view. *b*. The manubrium. *c*. The ensiform cartilage.

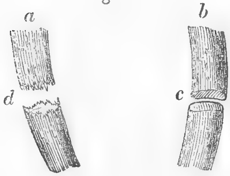
part of the neck upon the front of the chest when the animal's head is directed towards his side. The posterior portion of the sternum in both animals presents fewer differences for observation, being terminated by a cartilage called the ensiform, lettered *c*, fig. 11, and *b*, fig. 12. The attachments of the ribs to their cartilages also varies considerably, as seen in the subjoined sketch, fig. 13, where *a* represents a portion of the rib of the horse, with its cartilage, and *b* the same parts of the ox. In the former the lower end of the rib is received into a cup-like cavity in the upper part of the cartilage; a union which is further strengthened by indentations of their edges, locking into each other, but greatly limiting the extent of the motion between them: *d*, fig. 13. In the latter, however, we meet with a true synovial articulation in this place, marked *c*, in figs. 9 and 13. The nature of this attachment was several years since pointed out by Mr. Varnell, Demonstrator of Anatomy in the Royal Veterinary College. Besides the facilities for motion hereby obtained, the cartilages at their lower extremities are united to the sternum, as in the horse, by synovial joints: see *d*, fig. 9.

Fig. 12.



Lateral view of the sternum of the horse, showing its keel-like shape.
a. The cariniform cartilage. *b*. The ensiform cartilage.

Fig. 13.

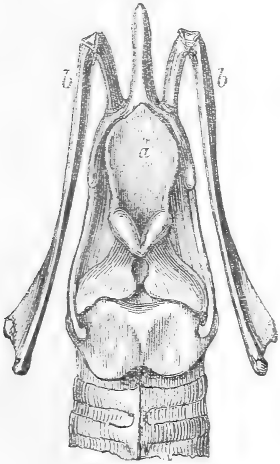


Portions of the ribs and their cartilages of the horse and ox.
a. Rib of horse, showing *d*, its indented union with the cartilage.
b. Rib of ox. *c*. Its synovial articulation with the cartilage.

Having described the mechanical arrangements of the walls of the thoracic cavity, we proceed to speak of the principal organs which are concerned in respiration: they are the larynx, the windpipe with its branches, and the lungs. At the upper part of the windpipe, which, as its name implies, is the conduit of the air to the lungs, we observe a peculiarly constructed organ, called the larynx. It differs in many particulars in nearly every variety of animal, and is more complicated in man than in any of the inferior creatures. The larynx discharges a double office, being the organ of voice, as well as the conduit for the air in breathing; and in proportion as the voice is incapable of modification, so do we find simplicity in its structure. It presents the same general appearance in all animals, being slightly altered to suit the tones uttered by each;—this will be observed on comparing figs. 14 and 15, which represent the larynx of the horse and the ox.

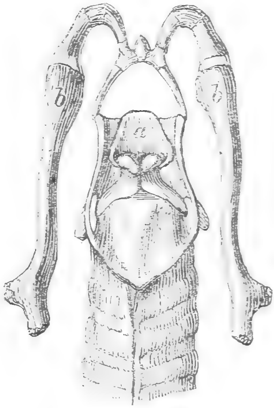
The larynx is composed of a number of cartilages which are united to each other more or less firmly. One of these, the epiglottis, *a*, figs. 14 and 15, defends the entrance into the windpipe, and in the act of swallowing it rises and closes over the opening of that tube, thereby preventing the passage of the food into it. Except in deglutition the epiglottis is always depressed to preserve a free and open conduit for the air to and from the lungs. The larynx is held in its situation through the medium of a singularly shaped bone, the os hyoides, *b*, figs. 14 and 15, which is united to the under and back part of the skull. The os hyoides gives attachment also to the muscles of the tongue, and as this organ possesses a great freedom of action in ruminants, we find the bone to be composed of more pieces in these animals than in many others: these pieces are likewise connected to each other by synovial joints. (Compare the os hyoides in the horse and ox.) The necessity for a modification of the cartilages of the larynx is apparent when we reflect on the varieties of the voice of our domesticated animals. We recognise the horse by neighing, the ox by bellowing, the dog by barking, the sheep by bleating, the pig by grunting, &c., &c. Many of these sounds are influenced by the existence of folds in the lining membrane of the larynx, called vocal cords. In the ox and the sheep we have the simplest form of the organ, for bellowing and bleating are little more than long-continued expiratory acts.

Fig. 14.



The larynx of the horse.
a. The epiglottis. *b*. The os hyoides.

Fig. 15.



The larynx of the ox.
The references are the same as in Fig. 14.

The ingress and egress of the air in respiration also differs. In the horse each is carried on through the nasal passages, except in coughing, when a portion of the air is expelled by the mouth. But in the ox and sheep the air enters and escapes both by the mouth and nostrils. This variation in part depends on the situation of the larynx with reference to the *velum palati*, and also on the length and position of the *velum*; peculiarities which can only be alluded to.

The lower part of the larynx is continuous with the windpipe, which is likewise composed of a series of cartilages arranged in a circular order. The windpipe, in common with the other portions of the respiratory passages, is lined with a mucous membrane, the secretion of which defends these parts from the irritation of the atmospheric air. This membrane not unfrequently suffers from a change of temperature, &c., and is the seat of those diseases recognised as catarrh, laryngitis, bronchitis, &c. The number of the rings of the windpipe will of course be governed by the length of neck: in the ox we usually find from 55 to 60. These rings are greater in substance at their front, being here more exposed to external injuries, than at their hinder part. They are united to each other by elastic tissue, which allows the windpipe without inconvenience to accommodate itself to the various movements of the neck. On the inner and back part of the rings, lying between them and the mucous membrane, is a thin layer of muscular fibres, the use of which is one of the vexed questions of physiology. The late Mr. Youatt denied the existence of this muscle in the ox;* I have satisfied myself, however, that it not only exists in this animal, but in every other which hitherto I have examined. It is a singular fact, and one which I am desirous of naming in this place, that in the dog the muscle is situated on the outer, and not on the inner, part of the windpipe. Mr. Percival is of opinion that the muscle resists the tendency of the elastic cartilaginous rings to form an elliptical-shaped canal; and, by converting the ellipsis into a circle, may thus tend to expand and not to contract the calibre of the tube.† Whether it be so in moderate action of the muscle or not, it is clear that when its fibres are contracting with energy, or are unduly stimulated, it must diminish the area of the canal. I would ask if it be not specially employed in the lower animals, in whom the vocal apparatus is exceedingly simple, compared with man, for producing the voice, by regulating the volume of the exhaled air, entering the larynx from the lungs; and also whether some of their intonations do not depend on the amount of its action?

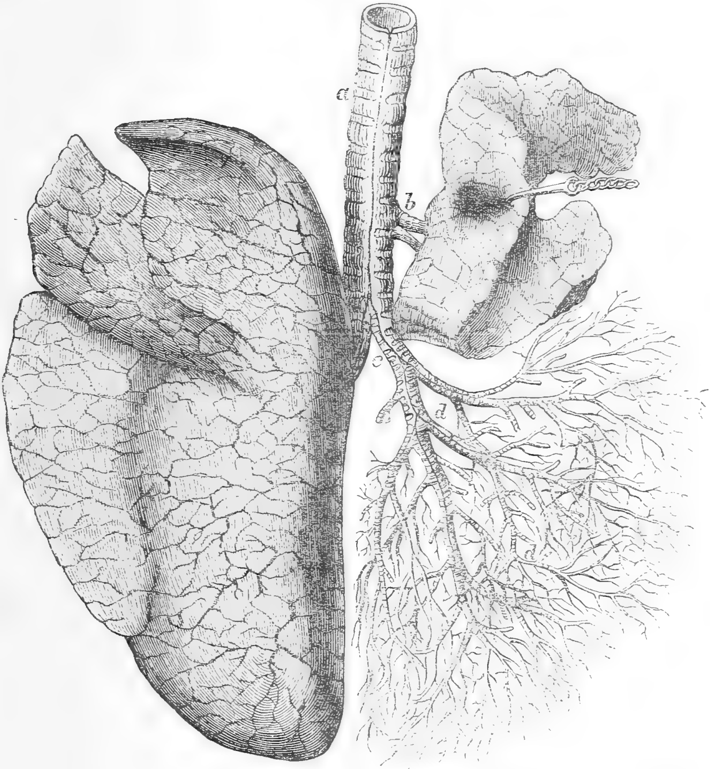
---

* See 'Cattle,' p. 374, Society for the Diffusion of Useful Knowledge.

† Anatomy of the Horse, p. 225.

The windpipe, passing down the neck, enters the chest between the first pair of ribs (see fig. 8); and, in the ox and sheep, it almost immediately afterwards sends a branch to the anterior part of the right lung (*b*, fig. 16):—this is called the *third bronchus*, and does not exist in the horse. A little below this, the windpipe divides into the two main bronchial tubes: one of which penetrates the substance of each lung, dividing and re-dividing into smaller and innumerable branches, which ultimately communicate with the air-cells (figs. 16 and 17).

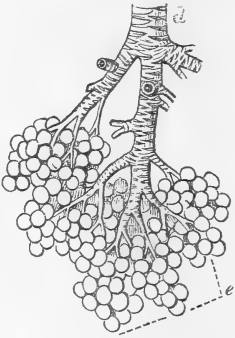
Fig. 16.



a. The windpipe. *b*. The third bronchus. *c*. The two principal bronchi. *d, d*. The ramification of the bronchial tubes throughout the lung.

It may here be mentioned that the chest is divided into two cavities by a membranous partition, *the mediastinum*, extending from before backwards, by which the right and left lung are separated from each other. Hence an explanation in part of the fact that pleuro-pneumonia, as well as other diseases, are frequently confined to one lung. The air-cells are clustered around each terminal bronchus, somewhat after the manner of grapes upon their stalk (fig. 17); and "it has been calculated by M. Rochaux, that in the human subject about 18,000 surround each bronchus, and that the total number in the lungs amounts to *six hundred millions*." "If this estimate," says Dr. Carpenter, "be even a remote approximation to the truth, it is evident that the amount of surface exposed by the walls of those minute cavities must be many times greater than that of the exterior of the body."[*] The air-cells follow no definite shape: they are for the most part flattened against each other, and are said to vary in size in the human subject from about the 200th to the 70th of an inch. In the ox the air cells are many times smaller than in man, and even more minute than those of the horse; and injected preparations of their capillaries show that the rete formed by these vessels is likewise finer, or more closely woven. This circumstance throws some light on the peculiar appearances met with in pleuro-pneumonia, and will hereafter be alluded to.

Fig. 17.



d. Terminal bronchus, communicating with *e*, the air-cells. The parts are highly magnified.

From the foregoing remarks it is apparent that the chief bulk of the lungs is made up of air-cells, surrounded by their network of vessels, and communicating with the minute ramifications of the bronchial tubes. Through the medium of these structures both elastic and contractile tissue enter into the composition of the lungs, by which they possess a certain amount of action independent of the expansion and contraction of the boundaries of the chest, and are thus enabled of themselves to assist in the process of respiration. The various structures forming the lungs are united together by areolar tissue, and they are also collected into small masses, termed lobules, which are joined to each other by the same material. Hence the expressions *interstitial* and *interlobular* areolar tissue: the former being applied to the bond of union between the different structures, and the latter to that connecting the lobules to each other. In the ox the lobules are very distinct, and the amount of areolar tissue is proportionably large (see fig. 19); thus again accounting for the appearances produced by pleuro-pneumonia.

Each lung is divided into lobes by a deep fissure:—the number of these lobes varies, although not to great extent, in different classes of animals. In the ox and sheep, the right lung consists of four, and the left of three lobes. The lungs are held in their

---

[*] Manual of Physiology, p. 389.

situation principally by the large vessels which are going to and from them, and also by the windpipe: they are covered externally with a serous membrane, the pleura, which is reflected upon the sides of the thoracic cavity, and forms also the mediastinum before spoken of. The lungs are everywhere free in the chest, except along their middle and upper surface, which is connected by the large vessels, &c. before mentioned, to the spine. They may be said to completely fill the cavity, their external covering of pleura being in contact with the reflection of the membrane which lines the chest.

Respiration consists of inspiration and expiration, and the bulk of the lungs will accord with the dilatation or contraction of the cavity; nevertheless they are not, as elsewhere stated, mere passive agents in the process. Many of the muscles which lie externally to the ribs, as well as those filling the spaces between them, the musculo-tendinous partition between the thorax and the abdomen, *the diaphragm,* and the abdominal muscles, are concerned in breathing, In expiration a portion only of the air contained in the air-cells is forced out by the pressing forwards of the viscera of the abdomen upon the thoracic cavity, through the contraction of the abdominal muscles, the diaphragm being at that time in a relaxed condition; the sides are also compressed at the same instant by the fall of the ribs, which is aided in part by their cartilages. This action ceasing, the diaphragm contracts, and assumes a flatter aspect; the viscera of the abdomen recede, and the ribs, the motion being assisted by their synovial joints, are drawn forwards and outwards, thus enlarging the cavity. To fill the vacuum which would thus be occasioned, a rush of fresh atmospheric air down the windpipe takes place: this equalizes the density of that portion of the air which had not been expelled, and which by its retention had become rarefied, and thereby assists the expansion of the lungs; the pressure to which they were subjected in expiration being now removed. As the chief use of this function is to eject carbonic acid gas from the system and produce oxygenated blood, so the quantity of air respired in a given time will be regulated accordingly. In a state of quietude and in health, the number of respirations in the ox are about 12 in the minute; being in proportion of 1 to $4\frac{1}{2}$ of the pulsations. The quantity of carbonic acid evolved varies from four to even eight per cent.; the rapidity of its production depending, amongst other causes, on the amount of exertion an animal undergoes. To supply the necessary quantity of oxygen to combine with the carbon, an increase of breathing must take place, otherwise death will quickly ensue. This rapid combustion of the carbon would, however, raise the temperature of the body far too high compatible with the maintenance of its functions; and consequently, as the circulation is increased, so will be the secretion from the follicles of the skin, bedewing the surface with a copious perspiration, which, by its evaporation, tends to regulate the amount of heat by depriving the system of its excess of caloric.

I might dwell at far greater length on this part of our subject; but having to speak of an important disease to which the respiratory organs are subject, I pass now to its consideration. The name given to this affection by almost universal consent is PLEURO-PNEUMONIA. I object, however, to the malady being thus designated; and if my view of its nature be correct, a less appropriate name could scarcely have been selected. The term *pleuro-pneumonia,* or *pneumo-pleuritis,* which has been proposed by some who consider the pleura more especially implicated, would immediately convey to the mind of the medical man that the disease was an inflammatory one, involving the substance of the lungs, with their investing membranes. Although there may not be much in a name, nevertheless it were to be wished that a better one had been adopted for this disease; as inflammation is not its essential feature, especially at its commencement. An incorrect nomenclature is sure to lead to false conclusions with regard to treatment, and thus the life of the patient will be greatly endangered.

Prior to our discussing the question of the true nature of this malady, I shall take a rapid view of the epizootics which have visited Europe from the earliest history to the present time. Mention is frequently made in the pages of Holy Writ of these diseases, and we read that among the plagues of Egypt a grievous murrain swept off the cattle. Homer frequently alludes to their ravages in Greece; and Virgil, Ovid, and other Roman authors, speak of their destructive effects among the cattle of Italy, &c. Of late years these maladies appear to have been on the increase, and within a short period England has been visited by *eczema-epizootica*, *pleuro-pneumonia*, and *variola-ovina.* The prevalence in this country of these particular diseases may certainly be said to be new to the present generation; but whether they have existed here at a remote period is somewhat doubtful. Believing this matter to be of some importance, we are induced to look into the history of these outbreaks; and should it appear that there is a reasonable ground for the supposition that pleuro-pneumonia is not altogether new, but that it has long since both visited and quitted our shores, we have thereby a strong reason to hope that it may again disappear from among us.

About the commencement of the Christian era diseases of this class are mentioned by Columella, who considered that they spread by means of their contagious properties. In the fourth century they are again noticed by Vegetius, who described some of their symptoms, and entertained similar views to Columella with regard to their extension.

In 810, it is recorded that all the cattle in Charlemagne's dominions, France, Italy, and Germany, were destroyed by one of these pests, the nature of which can only be conjectured, for the term "murrain" seems to have been of general application, and consequently its adoption throws but little light on the inquiry. From this period to the revival of the arts and sciences, nothing satisfactory can be learned respecting these epizootics; but in the sixteenth century we have detailed accounts of their progress and devastating effects. According to Ramazini, in 1514, and again in 1599, the Council of Venice forbade the use of beef and veal, and even milk, on account of the diseased condition of the cattle. The same author likewise states, that in 1691 sheep were swept off by thousands—pustular eruptions covering their bodies, which he unhesitatingly affirms were of the nature of small-pox. In 1693, the cattle in Hesse fell victims to "pulmonary phthisis:" it may, however, be reasonably doubted whether the disease was properly named; and it is probable that it was identical with the modern pleuro-pneumonia. Both cattle and sheep in Lower Hungary suffered severely at the commencement of the eighteenth century, the former from an epizootic, which is undefined, and the latter from small-pox: these maladies made their appearance early in 1712, and continued with great virulence throughout the year. About the same period the cattle in England were likewise attacked with a disease which bore a great resemblance to eczema epizootica.

During nine months in the year 1713, no less than 30,000 cattle are said to have died in Rome and its environs, of malignant dysentery, accompanied with tumours and ulcers on various parts of their bodies. And in 1730-31, Bohemia, Saxony, France, &c., experienced a heavy loss from the outbreak of a similar disease. In 1745, thousands of the cattle of Italy, France, Germany, and England, again fell victims to one of these pests. The malady seems to have been accompanied with many symptoms akin to those of pleuro-pneumonia, and to have been equally destructive. The lungs are described as its seat, and the *post-mortem* appearances, as recorded by Dr. Barker, bear a strong resemblance to those observed at the present day. Whether this disease extended hither through the medium of a vitiated condition of the atmosphere, or owed its origin to a more direct introduction, has not been satisfactorily proved.

> "Some authors assert that it was brought from Holland by certain calves, imported into the neighbourhood of London by a farmer for the purpose of crossing the breed; while others state that the lucrative views of an English tanner, who bought a parcel of distempered hides in Zealand which were forbidden to be sold, was the origin of the affection."*

In a pamphlet written in 1745 by Dr. Barker, it is stated that

---

* Simonds on Variola Ovina.

the malady was centred in the lungs; and its acute symptoms were preceded by a dry and husky cough, lasting from "a fortnight to three weeks." In the second stage, he says—

> "They begin to forsake their food, and if they be milch-cows their milk dries up—the fever, which was before obscure, begins now to be very perceptible: the cough increases, they breathe with great difficulty, and the eyes and nostrils in many of them begin to run with a thick and sometimes fetid rheum; the body grows hot, and the pulse is very full and hard. In three or four days after their milk is gone off, and they have ceased to eat and chew the cud, a purging most commonly comes on. The stools are at first thin and watery, soon afterwards they grow slimy and fetid, and sometimes they are mixed with blood. The purging continues for a week or more, if the cattle live so long; but if at the end of six or seven days it begins to abate, and the excrements grow more solid, it is a token of their recovery. The difficulty of breathing does not seem to be relieved by this discharge. When the disease has been of long continuance, the body has sometimes swelled extremely, either before or immediately after death, and even to such a degree as to burst the paunch; but in those which have died early in the disease, the body has seldom or never been known to swell. If the cattle begin to swell, and their flesh grow cold towards the end of the disease, it is a certain sign of approaching death. The continuance of the disease is very uncertain and precarious, for many have died in two or three days after the fever has appeared, others have lived six or seven, and some even twelve or fourteen days."

This graphic account of the symptoms of the epizootic observed by Dr. Barker, agrees in many essential particulars with those of pleuro-pneumonia; as is likewise the case with the *post-mortem* appearances, which he describes as follows:—

> "Upon opening the bodies of several which have died of this disease, I have constantly found the blood-vessels of the lungs stuffed up and distended with grumous or coagulated blood, and the bronchia or air-vessels so much inflated as to make the bulk of the lungs appear much larger than usual. And though some of these cattle were opened before the body was cold or the blood congealed in the other vessels, yet in those of the lungs it was constantly found to be coagulated to such a degree as not to flow out of the vessels upon cutting them."*

The lesions here spoken of, as well as the symptoms, bear so striking an analogy to those of the present malady, that I am most strongly inclined to believe it to have been pleuro-pneumonia which thinned the herds of the British agriculturist rather more than 100 years since; and it follows that it had so long disappeared from among us, as not to be recognised in its recent outbreak. If therefore I am right in the conjecture that the disease is not in reality new, it is evident that certain causes, of which we are now ignorant, came into operation and produced its withdrawal; and we are thereby encouraged to hope that ere long it will assume a milder type, and ultimately cease altogether.

It has already been stated that pleuro-pneumonia was preceded by the affection vulgarly called "the old epidemic," in which

---

* An Account of the present Epidemical Distemper amongst Black Cattle. London, 1745.

vesicles arise on the tongue, lips, feet, &c.: by some this malady is regarded as its cause. In my opinion they are perfectly distinct diseases, and neither of them can be viewed as a necessary sequela of the other. It is true that animals which have been affected with eczema are occasionally the victims of pleuro-pneumonia; but it is equally true that many of those which have died of pleuro-pneumonia have not been attacked with eczema. The two maladies are often seen on the same farm at the same time, and run their course perfectly independent of each other; besides which, eczema, unlike pleuro-pneumonia, shows no preference for the ox tribe; but extends to sheep, pigs, and even poultry. These facts are sufficient to prove their separate independence, without looking to the special characters of either affection.

The origin of pleuro-pneumonia, like all other epizootics and epidemics, cannot be traced to any positive cause:—

> "Exposure to the changeable state of the weather, the partaking of bad provender or stagnant water, are viewed by many as the chief causes of epizootics, while others trace them to a vitiated condition of the atmosphere: but whether such state consists of a mingling of mephitic vapours, or deleterious gases arising from either animal or vegetable decomposition, or from an excess of humidity or dryness, affecting the electrical condition of the air, they scarcely venture to conjecture." *

Pleuro-pneumonia undoubtedly existed on the Continent for several years before showing itself in England. Its extension here did not however depend, like variola ovina, on the direct importation of infected cattle, but the destructive poison was wafted hither through the medium of the air, as has been the case with that of Asiatic cholera and similar pests. The atmosphere is, consequently, to be looked to as the source of the disease; but in the present state of science we are compelled to admit that the precise nature of the poison is as little understood as it was centuries since. Experience proves that a vitiated condition of the air gives rise to diseases which speedily destroy both animal and vegetable life; but we fail by analyzation to detect the deleterious matter. The true cause of the potato disease has engaged the attention of our scientific investigators, but both it and the laws which govern the extension of the affection have hitherto remained undiscovered. Nor is this a matter of surprise; for chemistry equally fails in demonstrating such substances as our senses quickly recognise. The perfume of a bouquet, and the most offensive odour, are alike undetectible by chemical means. We often judge, therefore, by the effects which we observe to follow the inhalation of an atmosphere which is thus charged, and of this we have a striking illustration in the deleterious results of the *malaria* engendered by the rays of the sun on stagnant water in marshy districts.

---

* Simonds on Variola Ovina.

The mingling of noxious matters will occasionally produce a physical change in the air; a remarkable instance of which is thus described by Dr. Prout in his Bridgewater Treatise.* He says that—

> "He had for some years been occupied in investigations regarding the atmosphere; and for more than six weeks previously to the appearance of cholera in London had almost every day been engaged in endeavouring to determine, with the utmost accuracy, the weight of a given quantity of air under precisely the same circumstances of temperature and pressure. On a particular day, the 9th of February, 1832, the weight of the air suddenly appeared to rise above the usual standard. As the rise was at the time supposed to be the result of some accidental error, or of some derangement in the apparatus employed, in order to discover the cause the succeeding observations were made with the most rigid scrutiny; but no error or derangement whatever could be detected. On the days immediately following, the weight of the air still continued above the standard, though not quite so high as on the 9th of February, when the change was first noticed. The air retained its augmented weight during the whole time these experiments were carried on; namely, about six weeks longer. The increase of the weight of the air observed in these experiments was small, but still decided and real. The method of conducting the experiments was such as not to allow of an error, at least to an amount so great as the additional weight, without the cause of that error having become apparent. There seems, therefore, to be only one mode of rationally explaining this increased weight of the air at London, February, 1832; which is, by admitting the diffusion of some gaseous body through the lower regions of the atmosphere of this city considerably heavier than the air it displaced. About the 9th of February the wind, which had previously been west, veered round to the east, and remained chiefly in that quarter to the end of the month. Now, precisely on the change of the wind the first cases of cholera were reported in London; and from that time the disease continued to spread. That the epidemic cholera was the effect of the peculiar condition of the atmosphere is more perhaps than can be safely maintained; but reasons, which have been advanced elsewhere, lead the writer of this treatise to believe that the virulent disease termed cholera was owing to the same matter which produced the additional weight of the air."

I am not aware if any physical alterations of the atmosphere have accompanied the present outbreak of Asiatic cholera; but the foregoing statements, together with the quotation I have just made, are sufficient to establish the point that the air may be vitiated by an admixture of various matters.

By a careful investigation of epizootic diseases we become acquainted with certain laws which govern their spread, as well as with the secondary causes which predispose animals to their attack. Some of these maladies are contagious or infectious, as is the case with the small-pox of sheep, and may be also with pleuro-pneumonia. Many an outbreak can be clearly traced to diseased animals being brought upon the farm; nevertheless this is not a necessary consequence of such a procedure; and very

---

* Chemistry, Meteorology, and the Functions of Digestion considered with reference to Natural Theology, by William Prout, M.D., F.R.S., &c., p. 353 *et seq.*

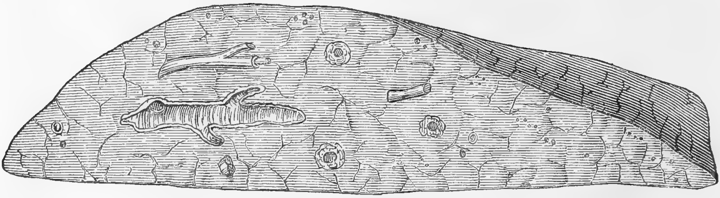
often the malady breaks out independent of any such cause. The very existence of a doubt on the contagious nature of pleuro-pneumonia should put the purchaser of cattle on the alert, and prevent his obtaining them from an infected district. Having been led to make the following remarks in my work on Variola Ovina, with reference to infection, and they having a practical bearing on this subject, I trust I shall be excused for introducing them here:—

> "Whatever the combination of causes may be which produce these maladies, certain it is that very many of them assume an infectious nature, otherwise we could not account for animals separated and kept apart from those which are diseased, frequently, and sometimes altogether escaping; while those are sure to become early victims that are allowed to pasture or live with the affected: besides we can often succeed in producing the malady by inoculating healthy cattle; thus showing how closely the spread of the disorder depends upon contagion or infection. The fact, however, of animals when in health, if placed with affected ones, contracting a disease of the same kind as that which the latter are suffering from, is the best proof of the infectious or contagious nature of a complaint. An animal escaping an attack, when such affections are raging in the locality in which it is placed, may arise from a variety of causes, as non-susceptibility, and also the possibility of the exciting agents never having been brought within its sphere of inhalation."

Whether an epizootic be or not a contagious disease, its victims are rendered susceptible of receiving the malady by the operation of secondary causes. This predisposition, as it is called, may be induced from a variety of circumstances, and a mere alteration in the food will be occasionally sufficient to produce it. A want, however, of nutritious diet—exposure to the changes of the weather—pasturing on wet and cold soils—neglect of a proper ventilation of the building the animals occupy—inhalation of offensive gases from accumulated manure—the fatigue of being removed from one locality to another—are the general predisposing causes of pleuro-pneumonia and similar diseases. Care should, therefore, be always taken by a better system of management, feeding, &c., to avoid everything which tends to bring the system into a condition favourable for the reception of the special cause of an epizootic, and more especially when such is raging in the neighbourhood. All these means will, however, fail when the disease is purely an infectious one, from a neglect of isolation or the removal of the healthy from the diseased. It is a well established fact that infection has its limits; and although these may ever remain undefined as to their extent, still daily experience proves that the removal of animals but a short distance from each other, and the prevention also of indirect communication between them, will at once put a stop to the spread of the malady.

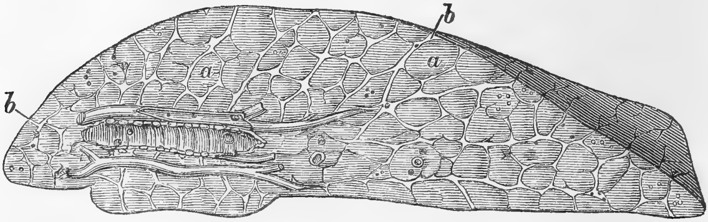
From the preceding remarks, it is evident that I look chiefly to a vitiated state of the atmosphere as being the cause of pleuro-pneumonia, and hence the greater necessity for the avoidance of all predisposing causes. If this be the case, it may be asked how the empoisoned air produces its morbid results? I answer, not by its direct irritation on the membrane lining the air-passages, but by its specific action on the blood, which fluid, thus acted on, does virtually by its changed condition subsequently affect the pulmonary tissues. I have before stated my conviction that pleuro-pneumonia is not an inflammatory disease in the strict and legitimate meaning of the term. In order more distinctly to explain my view of the manner in which the abnormal condition of the lungs is produced, I beg to direct attention to the annexed sketches, which exhibit sections of the lung of the horse and ox. Fig. 18 represents the lung of the horse, which on being compared with fig. 19 (a similar portion of the lung of the ox) shows its structure to be more condensed, and a less amount of areolar tissue to enter into its composition. In the anatomical portion of this lecture, mention has been made of the *lobules* of the lungs and their connexion to each other by areolar tissue, designated the *interlobular* tissue. The lobules in the ox are much more distinct, and they are also very loosely joined together, consequently a much larger proportion of the interlobular tissue exists here than in the horse. This excess of the connecting medium when infiltrated with the colourless portions of the blood, gives rise to those light-coloured or yellowish bands which intersect the lungs in all directions in pleuro-pneu-

Fig. 18.



A section of the lung of the horse, showing its condensed structure, and relative deficiency of the interlobular areolar tissue, which is represented by the irregular dark lines scattered on its cut surface.

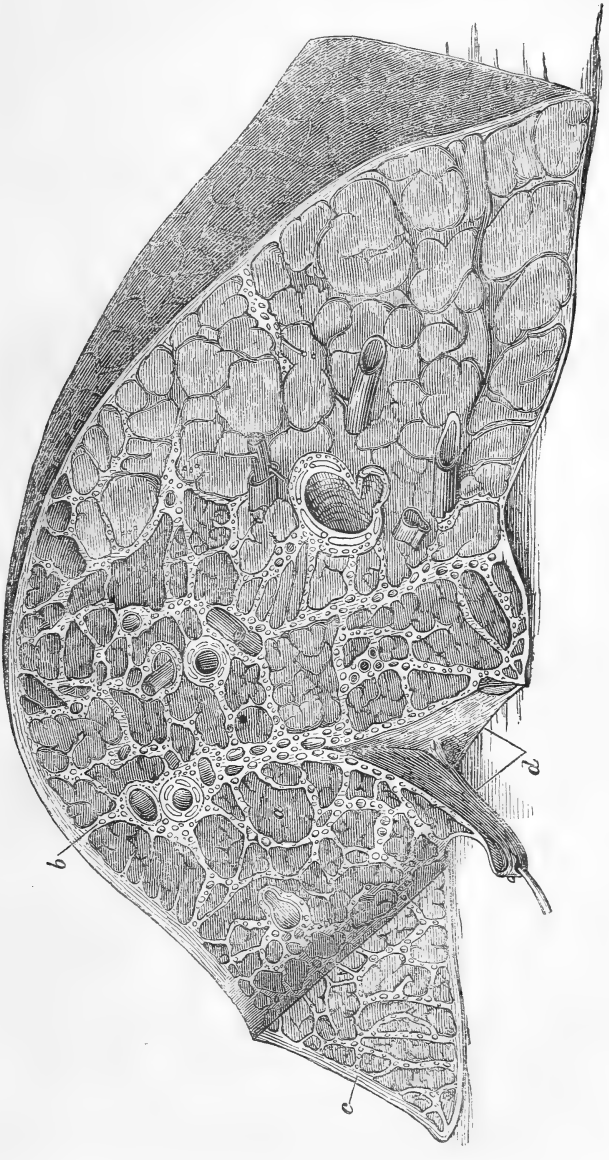
Fig. 19.



A section of the healthy lung of the ox, with its lobules and interlobular or connecting areolar tissue. *a, a.* The lobules. *b, b.* The interlobular areolar tissue.

monia (see figs. 20 and 21). These appearances, therefore, are to be referred to original structure, as well as to the character of the disease; and the reason the lungs of the horse, when loaded with the serous parts of the blood, do not show a similar condi-

Fig. 20.

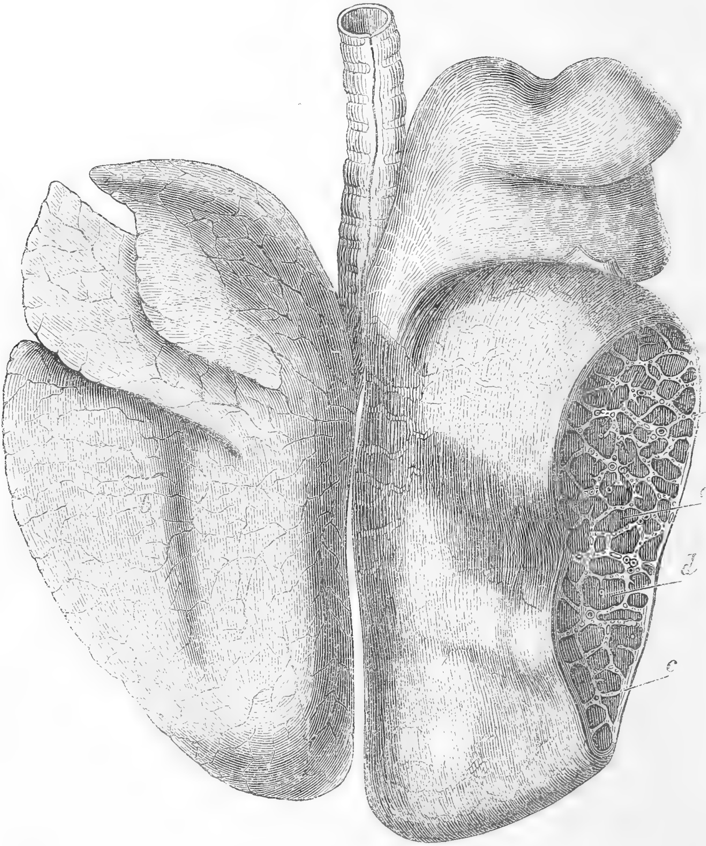


Section of a diseased lung, showing the nature of the changes its structure has undergone.

a, a. The dark patches produced by the retained red corpuscules of the blood in the meshes of the interstitial tissue, and also in the capillaries of the air-cells. *b.* The interlobular areolar tissue, distended with the fibrino-albuminous portions of the blood. *c.* The sub-pleural tissue, similarly distended. *d.* A section of the interlobular tissue, exhibiting its great increase in thickness.

tion, is their deficiency of the interlobular tissue. Besides the union of the lobules here spoken of, I have also stated that the various component parts of the lungs are held together by *interstitial* areolar tissue. The network of this tissue is very minute, and when in this disease the red corpuscules of the blood escape from the capillaries by a rupture of their coats, it retains these bodies in its meshes, and assists in producing the dark colour of the isolated patches. This colour likewise depends in part on many of the capillaries being distended almost to bursting by the red corpuscules. The united pressure of the overloaded vessels, and of the infiltrated interlobular and interstitial tissues,

Fig. 21.



a. The right lung of the ox, considerably increased in size, and covered here and there with effusions of fibrine. *b.* The left lung, still retaining its healthy condition. *c, c.* The yellowish bands which intersect the diseased lung in various directions, being produced by the interlobular tissue surcharged with the fibrino-albuminous portions of the blood. *d, d.* The dark-coloured patches, arising from a retention of the red corpuscules, &c.

compresses the air-cells of the lungs, and prevents the entrance of the atmospheric air into them; hence the absence, in the advanced stages of pleuro-pneumonia, of the respiratory sound in the affected parts. The great depth in the colour of some of the patches is also produced by the same cause; for the pigment of the accumulated corpuscules cannot be decarbonized, from the non-entrance of the oxygen of the air into the cells.

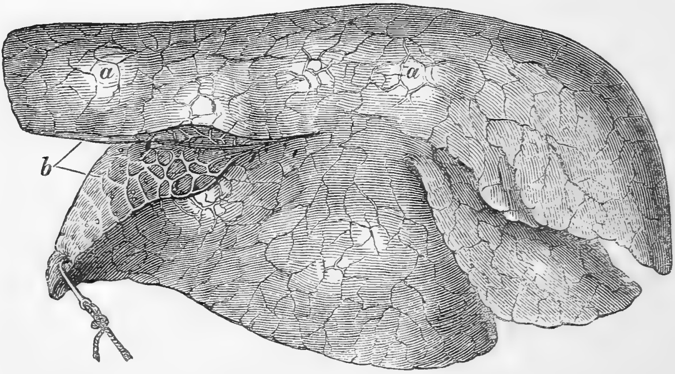
I have already remarked that the vitiated atmosphere does not act as a direct irritant to the pulmonary tissues or mucous membrane of the air-passages, a fact which is proved by the absence of all the usual symptoms of catarrh, laryngitis, or bronchitis, as precursors of pleuro-pneumonia. Besides, if such were the case, both lungs would be equally affected; whereas it is well known that the disease is very partial, and that the right lung is principally involved (see fig. 21). The aërial poison, whatever may be its nature, being carried by the ordinary process of respiration into the air-cells of the lungs, exerts its baneful influence upon the blood in its circulation through the capillaries. The blood thus impregnated with something detrimental to its healthy condition undergoes changes similar to the solids when diseased, and these changes are figured forth in the pulmonary tissues.

Each organ of the body seems susceptible of being acted upon in a special manner by deleterious matters entering the circulation: thus the poison of small-pox reacts on the skin; that of glanders on the mucous membranes of the nasal cavities,—of rabies on the nerves,—of eczema on the lips, tongue, and feet,—and of pleuro-pneumonia on the lungs.

The amount of the deleterious matter received at each inspiration appears to be insufficient to interrupt at once the functions of the lungs, for, were this the case, death would speedily occur from asphyxia; whereas we have constant proofs that the disease we are considering is partial in its attack, and insidious in its nature, making its way stealthily; being very often unobserved, until it has made great inroads on the constitution. This character of the affection is alone sufficient to create a doubt of its being inflammatory, for inflammation of the lungs, even at its commencement, is marked by unmistakable indications of ill-health. The absence of the ordinary symptoms of *pneumonia*, together with the peculiar changes observed in the lungs, have satisfied me that pleuro-pneumonia is not of an inflammatory nature at its outset, and that inflammation is rather the result than a cause of the disease. It is difficult to explain the precise change which takes place in the blood from the operation of the aërial poison; but it appears to me that the vitality of the fibrine is interfered with, and that it, with the albuminous constituents of the fluid, also altered in quantity, is transuded from the capillary vessels, and finds its way into the areolar tissue of the lungs, accumulating where this tissue exists in greater abundance, namely, in the interlobular spaces. This inordinate transudation seems to depend on a tendency in the blood to separate into its several constituents, arising most likely from the diminished vital force of the fibrine, and an arrestation to the conversion of the albumen of the serum into fibrine. The fibrino-albuminous portions of the fluid are thus changed, and probably also augmented, and their exudation is a natural consequence of such condition. The red corpuscules, being in part deprived of the liquor sanguinis in which they float, are retained in the capillaries, where they accumulate in unlimited numbers, obliterate their passage, and compress the air-cells they surround, so as to stay the entrance of the air, and produce, as elsewhere stated, the dark-coloured spots which stud the lungs. It is these effusions and the obliterated condition of the vessels which give bulk, increased weight, and solidity to the lungs, and destroy their function as aërifying organs.

From this explanation it is evident that I regard pleuro-pneumonia to approach nearer to a *dropsical* than to an *inflammatory* disease. The lungs, if examined at the commencement of the affection, will show that the morbid action commences here and there in their substance, and that these patches quickly increase in size so as to run into each other. We have also frequent opportunities of verifying these remarks in animals which have died in the advanced stages of the malady, from the circumstance that one lung is principally affected, the other exhibiting the beginning of the disease. Fig. 22 is inserted for the purpose of rendering this description more evident. The spots marked *a a* represent the tumified portions of the

Fig. 22.



Lung, showing the commencement of pleuro-pneumonia.
a. Elevated spots produced by effusion. *b*. A cut carried through one of the spots, to demonstrate the nature of the change producing it.

lung, which the cut *b* discloses to be referable to effusion into its substance.

The exudation of the altered liquor sanguinis is not limited to the lungs themselves, but extends to their investing membrane, the pleura, thus accounting for the depositions of semi-solid fibrine on their exterior, and the existence of serous effusions in the cavity of the thorax. That these results are not produced by inflammation is clear from the circumstance that in innumerable cases no redness of either the pleura covering the lungs or lining the chest can be detected; both the fibrine and the serum being likewise perfectly colourless. Dropsy of the chest may be said to be now associated with dropsy of the lungs. Although inflammation takes no part in the original production of these morbid lesions, still, as previously remarked, it may arise as a consequence, and this I believe is generally the case with those animals which recover. The blocking up of the air-cells, vessels, &c., produces death of these structures; and when this is partial and of little extent, portions of the lung will ultimately become detached, and be enclosed in sacs formed by the adhesive stage of the subsequent inflammation. This will also explain how it is that collections of pus and other morbid products are occasionally met with in our *post-mortem* examinations of long-existing cases of pleuro-pneumonia. It ought therefore to be no matter of surprise, nor to be viewed as an opprobrium of the veterinary art, that an affection which depends on an empoisoned atmosphere, and is associated with such extensive lesions of organs so essential to health, and which stealthily but securely wends its way and saps the very vitals, should prove so destructive to life, and likewise resist the most vigorous and scientific treatment.

Having given my view of the nature of the malady, I proceed to narrate the symptoms which accompany it. The disturbance of the animal's health is rarely observed until the disease is fully established, and effusion into the lung has made some progress. Proprietors of cattle should, therefore, be early and late with their stock, narrowly watching the slightest indication of ill-health. It will often be observed that oxen at pasture, when the disease is commencing, will early in the morning be separated from the herd, standing under the hedge with their backs arched, coats staring, and refusing to eat; while as the day advances they will join the rest and appear in their usual health. A slight but husky cough will be occasionally recognised, and now and then the breathing will be increased, as if the animal had undergone some extra exertion; while in milch-cows there will be a diminished amount of milk in addition to the above symptoms. As the disease progresses, the cough becomes more frequent and husky, the respiration is hurried, the pulse increased and somewhat oppressed, the appetite diminished, rumination suspended, bowels constipated, surface of the body chilly, &c. In the more advanced stages the respiration is difficult, laboured, and painful; the patient is frequently lying, or if standing, the head is protruded; the mouth is covered with a frothy saliva; the muzzle is cold; rigors occasionally come on; and the pulse is rapid and often indistinct. An enlargement of the right side of the chest can generally be detected in this stage of the malady; percussion gives a dull sound, and auscultation detects an increased bronchial respiration, with a crepitating râle in some parts, but a total absence of sound in others. Approaching death is shown by frequent moaning, grinding of teeth, total loathing of food, cold extremities, wavering pulse, distressed breathing, liquid stools, and distension of the rumen by the disengagement of gaseous compounds from the ingesta. This deranged condition of the digestive organs is probably owing to the high carbonization of the blood; as the elimination of the carbonic acid is prevented by the obliteration of the air-cells of the lungs.

The length of this lecture forbids a more minute detail as well as a separate analyzation of the symptoms, and therefore I pass on to speak of the principles which should govern our treatment of the disease. The first remedy to which I shall allude is bloodletting. The propriety of abstracting blood will depend on the stage of the malady, and the amount of symptomatic fever which is present. It must be done early, or not at all; for in proportion to the extent of the effusion, so will be the debility of the patient. To bleed late is to hasten a fatal termination; but if we attend to the animal at the very commencement of the disease, much good will be done by a bold bloodletting. No rule, however, can be laid down as to quantity to be abstracted, but the pulse must be carefully watched, and as soon as its character is altered the bleeding must be suspended. I do not recommend an early bloodletting for the single purpose of allaying the febrile condition of the system, but to withdraw a portion of the vitiated fluid which has laid the foundation for, and is quickly building up, the disease.

Another remedy of frequent adoption is the exhibition of purgative medicine. In most disorders it is of the first importance to clear out the *primæ viæ,* as thereby we not only remove offensive and offending matters from the system, but subdue the excitation which is present by the nauseating effects of the medicine, which is further assisted by the agent increasing the intestinal and other secretions. If constipation is present, even in the advanced stages of pleuro-pneumonia, a gentle aperient may be given, but cathartics should be avoided. I have already stated that diarrhœa often comes on as the case approaches its end; and it should be remembered that this morbid condition of the bowels is very easily excited by purgative medicine. Cathartics, like bloodletting, must be used cautiously. They are admissible at the beginning of the affection, but rarely afterwards. The ordinary saline mixtures are as good as any, but they ought to be given without the large doses of ginger, &c., with which they are too generally blended.

Diuretic agents stand next in the list. Medicines of this class stimulate the kidneys to increased action, and their employment is found to be associated with far less weakening effects on the lower animals than is the case with purgatives. They may, therefore, be frequently and quickly repeated. Diuretics carry off a considerable portion of the watery parts of the blood, and hence their great use in affections of a dropsical nature. The nitrate of potash is one of the safest and best of our diuretic agents, and I especially recommend it in the treatment of pleuro-pneumonia. I do this for several reasons; among which is the established fact that the alkaline carbonates and nitrates are of the greatest benefit when the blood itself is in an abnormal condition. One of the best ways of using the nitrate of potash is to add it to the water which is given to the animal to drink.

Sedative medicines have been extensively employed by some persons in treating this disease, but in my experience they have rarely proved of service; nevertheless, their occasional administration will be needed, especially when the circulation is much excited: Pulvis Doveri; opium; and ext. belladonna are the most valuable agents of this class. Calomel in combination with opium has also its advocates, and in certain cases I have given it with advantage.

Diaphoretics, or medicines which promote the secretions of the skin, are beneficial, but their action should always be assisted by warm clothing, without which they are nearly useless. Antim. tart. is one of our chief diaphoretics; I have found it, however, to act too freely on the mucous membrane of the intestinal canal and to produce thereby considerable mischief; as a rule I do not employ it, and more especially in protracted cases of the malady. The other preparations of antimony are not open to the same objection, and these, with the Pulvis Jacobi. should be selected. To effect a copious secretion of perspiration, the skin of a recently killed sheep, applied while yet warm to the back and sides, surpasses everything we have as yet tried.

Diffusible stimulants and tonics are, in my opinion, the most valuable of all remedies, and invariably I have recourse to them as early as circumstances will permit. Of late we have heard much of the beneficial effects of brandy as a diffusible stimulant, and doubtless in the second stage of the malady it has proved of service. I prefer, however, the spt. æther. nitr. and the liq. ammo. acet. in combination, the ammonia being in excess.

In the advanced stages, however, even these agents fail to support the system against the debilitating effects of the disease, and we must now employ both vegetable and mineral tonics; the sulphates of iron, and quinine, gentian, ginger, columba, and the barks, are the best. Before concluding these remarks on the treatment, which are of necessity very much condensed, I shall allude to another remedy which has many advocates, and properly so in my opinion, namely, counter-irritation, or the application of stimulating ointments and liniments to the sides of the chest. This class of remedies is generally adopted when active inflammation pervades some internal organ, and with the happiest results; and although I do not view pleuro-pneumonia as essentially an inflammatory affection, still we can easily understand that benefit will follow the use of a counter-irritant. By the long-continued action of an agent of this kind, the inflammation which it excites in the skin will be attended with effusion of the albuminous parts of the blood into subcutaneous tissue, and thus we artificially produce a disease here analogous to that of the lungs and thereby give relief to those organs.

I might add many observations to the foregoing on the nature and treatment of this disease, but hope to have said sufficient in explanation of the principles which should govern our proceedings both with a view to its prevention as well as cure. It is evident that no specific can exist for such a malady; and it is likewise equally so that he who undertakes its treatment without a knowledge of its nature, and of the structure and functions of the organs it affects, is acting like an ordinary artisan who sets about the repair of a machine the wheels and levers of which he has never investigated.

XXX.—*Miscellaneous Results from the Laboratory.* By J. Thomas Way, Consulting Chemist to the Society.

(It is proposed to publish under this title, from time to time, the results of isolated analyses made by the Chemist of the Society, which, although not sufficiently important to form the subject of a separate communication, may yet possess an amount of value to justify their introduction in a Journal devoted to agricultural improvement.)

Analysis of Sprats.—It is well known that on the coasts of Sussex, Kent, and Essex, such quantities of sprats are at certain seasons taken, that they are frequently employed as an economical and very powerful manure. They have been used for many different kinds of crops; but more especially for wheat and hops, which plants are known to be benefited by highly nitrogenous manures.

Although the general chemical characteristics of fish are well known, I was induced to examine the composition of sprats, partly to develope their exact manurial value, and partly in the hope of finding some way of cheap preparation by which they might be rendered fit for transportation to a longer distance than their perishable nature will now admit. They were first examined in the year 1847, and, to ascertain that their composition was not variable, a second time in the following season, December, 1848.*

In all cases a sufficient number of fish was operated upon to ensure an average result. They were bruised in a mortar, and then dried at the temperature of boiling water; from the dry mass, the oil or fat was extracted by digestion with ether; after which, the residue, again dried, was analyzed for nitrogen. The mineral matter was obtained by burning a quantity of the sprats previously dried. Thus examined, they were found to yield in 100 parts:—

	Sprats of 1847.	Sprats of 1848.
Water	64·60	63·65
Oil	19·50	18·60
Dry Nitrogenous matter	15·90	17·75
	100·00	100·00

The specimen of 1847 was not examined for nitrogen; that of 1848 was. The dry matter (after separation of the oil) gave:—

	Per Cent. of Nitrogen.
First experiment	11·75
Second experiment	11·31
Mean	11·53

Upon this datum it will be found that the sprats in their natural condition contain 1·94 per cent. of nitrogen. The quantity of mineral matter obtained by burning the fish was—

	Sprats of 1847.	Sprats of 1848.
Ash per cent. on the natural fish	2·12	2·10

A result which is identical for the two years. These ashes had the following composition:—

	Sprats of 1847.	Sprats of 1848.
Silica	traces	·30
Phosphoric Acid	43·52	40·49
Sulphuric Acid	traces	1·40
Carbonic Acid	none	none
Lime	23·57	27·23
Magnesia	3·01	3·42
Peroxide of Iron	·28	·65
Potash	17·23	21·89
Soda	1·19	none
Chloride of Potassium	none	2·31
Chloride of Sodium	11·19	2·31
Total	100·00	100·00

1000 grs. of the fish in its natural state, when examined directly for sulphur, gave 1.50 grs.

This ash is precisely what we should expect to find it—the phosphate of lime being furnished by the bones, and the potash by the fleshy substance of the fish.

It is worthy of remark, that the quantity of potash should be so consi-

---

* I am told that there is a marked difference between the fish of the early and late months of the season; they are at first plump and fat, and subsequently become shrivelled and lean, when they would probably contain much less oil.

derable, not as a physiological fact of an unexpected character, but in relation to the composition of guano, which is in reality produced from fish, having probably a chemical character very closely allied to that of those we are discussing. It will be remembered that in guano, according to analyses I had the honour of publishing in this Journal, the per centage of phosphoric acid being 25·0, that of potash was shown to average 3·5, or about 1-7th. In the original fish, however, if we may judge by the present analysis, the relation is more nearly as 2 to 1; so that in the production of guano, three parts out of four of the potash disappear. This peculiarity is mentioned rather as curious than as of any importance. The size of bone in the fish in relation to its flesh might possibly account for the above-named circumstance; but of this I have no means of judging.

As a matter of more practical importance, I would draw attention to the similarity in composition between some of our cultivated crops and that of sprats. Wheat, for instance, contains about 2 per cent. of nitrogen; so does this fish. 100 lbs. of wheat require about 1¾ lbs. of ash, of which about one half is phosphoric acid, and 1-3rd potash. 100 lbs. of sprats contain 2 lbs. of ash, of which 2-5ths is phosphoric acid, and 1-5th potash. What manure should be more fit to produce a bushel of wheat than ½ cwt. of sprats?*

Indeed, there is nothing surprising in this resemblance. The composition of sprats would probably be found nearly identical with that of any *entire animal* examined in the same way.

We know that wheat contains everything that is necessary to support life and to increase the animal frame; in other words, it is identical or nearly identical in composition with the body which it nourishes. Sprats then may be taken as the type of animal—wheat as that of vegetable life, and there can be no doubt of their mutual convertibility, when placed in the proper circumstances.

I have dwelt upon this point in order to show how very valuable a source of manure, and consequently of food, we have in the waters that surround our shores, if we could work out the problem as one of economy. Practically we do so at this day, by bringing guano, which is *digested fish*, from far distant parts.

The use of fish manure is very limited, being confined to within a certain distance of the sea-shore, and this for obvious reasons. In the first place, it requires to be used in large dressings, although it is, weight for weight, at least four times as powerful as farm-yard dung; consequently the expense of carriage, added to its original cost, soon places a limit to the transportation of this kind of manure. Secondly, it will not keep for any length of time; and at whatever season it is taken, it must be at once, or within a few days, applied to the ground. This is another serious drawback to its employment. The third and last objection which we shall bring against the employment of sprats as a more general manure, is the great uncertainty of the collection; in some seasons being very scarce, in others so abundant that it pays the farmer to send his waggons 20 or 30 miles for them.

I stated that my motive for examining sprats was to ascertain whether by any means they could be preserved and *concentrated* for transportation. I was unprepared at the time for the discovery of so large a per centage of oil in the fish; but it immediately occurred to me that the circumstance might render it possible to make them more generally available for manure.

So far as we know, oil is of no value as manure, or at all events of a

---

* That is to say, supposing that in the production of wheat no loss of manure occurs, a supposition which is rendered very doubtful by Mr. Lawes' experiments.

value far beneath that which it holds as an article of commerce. The oil of sprats is a clear, limpid fluid, and would no doubt be highly prized in the market. It would probably be capable of easy extraction by pressure,* which at the same time would remove the water and *reduce the sprat to a dry mass.* This dry residue would contain nearly 12 per cent. of nitrogen,† a quantity greater than in any known manure, with the exception of guano. The manure would be portable, and worth its carriage to any distance; and from the pressure to which it had been subjected, together with the absence of water, capable of being kept for any length of time till it was required for use as a drill manure.

These remarks are only thrown out as hints to the many reflecting men who are ever anxious to take advantage of the opportunities which are so generally presented to us, if only the intelligence and energy to benefit by them be not wanting. It is not for me to say whether the preparation of a dry manure from fish, depending for its expense on the product of oil, is economically practicable; but should it be so, I am sure that sooner or later the redundant capital of the country would be brought to bear upon this new *importation* of manure, to the advancement of general agriculture and the benefit of the speculators.

The circumstance which alone makes the matter worthy of consideration is the fact—previously, I believe, unobserved—of the large quantity of pure oil which sprats contain, together with the possibility of extracting it by pressure with equal or greater ease than that of linseed. The great difficulties which would stand in the way of this manufacture would be, first, the *uncertainty* of the season in regard to quantity; and, secondly, the short period of the year during which the manufacture could be carried on. Of the first circumstance I have very little knowledge; but the remedy in such case would be of the same kind as that which I should propose for the second trouble. In order that the presses and other machinery of the sprat-manure maker should not be idle during two-thirds of the year, he should also be a manufacturer of linseed-cake, in the production of which he should employ himself when the other branch of his business was from circumstances impracticable.

It is probable that many other kinds of fish, some of which are caught in enormous quantity, might be applicable to the same purposes.

Liquid Manure.—The following analysis of the contents of Mr. Huxtable's liquid-manure tank will probably be of use as furnishing a practical basis upon which the farmer may build his calculation for the use of tank-water.

The tank in question receives the liquid running from the cow-houses, the stables, and the piggeries—none of the water from the yards or the buildings is allowed to find its way into it; Mr. Huxtable's practice being to dilute the tank-water at pleasure and according to circumstances at the time of using it. The liquid mainly consists, therefore, of the putrid urine of cows. In taking the specimens for analysis, the contents of the tank were stirred in such a way that an equal proportion of the sediment could be collected; owing, however, to the mode in which the urine is conveyed to the tank, the deposit in it is very slight.

It must be understood that the analysis exhibits the composition of putrid urine, or tank-water which has been kept some time; in this condition all or almost all of the animal matters will have passed into the state of ammonia; but with this exception, there is no difference between the urine in the two states, and the analysis will for all practical purposes equally represent the value of fresh tank-water as a manure.

---

* Since the above was in type, I have been informed by a gentleman, that with the aid of a powerful press he had failed to extract more than 1½ or 2 per cent. of oil from the fish.

† Practically perhaps so perfect a result could not be hoped for.

The analysis was made in my laboratory by Mr. F. Eggar:—

	Grs. of solid residue.
One gallon of the liquid manure gave upon evaporation .	1208·42

of which

	Grains.
The combustible portion weighed	397·63
The incombustible portion, or *ash*	810·79

The combustible portion consists principally of carbonate and muriate of ammonia, with some unchanged animal matters. To ascertain the proportion of ammonia—the only point considered of importance in the combustible portion—two experiments were made by distillation of the original liquid with potash, the ammonia being collected in the usual way.

	Grs. of Ammonia in the Gallon.
The first experiment gave	362·33
The second ,, ,, ...	350·58

The mean of the two results giving 356·45 grains of ammonia as the quantity in an imperial gallon.

The ash was analyzed in the usual way. I have placed in one column the per centage composition of the ash, and in another the quantities of the different mineral substances which exist in a gallon of the tank-water:—

	In 100 parts of the Ash.	In a gallon of the Tank-Water.
		Grains.
Silica	1·01	8·18
Phosphoric Acid	1·10	8·91
Sulphuric Acid.	12·97	105·16
Carbonic Acid	12·32	100·05
Lime	2·61	21·24
Magnesia	1·17	9·49
Peroxide of Iron	1·73	14·02
Potash	43·47	353·01
Soda	none	none
Chloride of Potassium	4·28	34·86
Chloride of Sodium	18·75	152·26
Sand, &c. (accidental impurity)	·44	3·56
Total	99·85	810·74

In addition to the chlorine, set down in combination with potassium and sodium, another portion escapes in the preparation of the ash with the ammonia.

A direct determination of chlorine was made in the original liquid, which gave an excess of 98·84 grains in a gallon of this ingredient over that obtained by the method of burning.

The first column of the preceding table is interesting on more than one account. It will be seen that the chief ingredients of tank-water (setting aside the ammonia) are the sulphate and carbonate of potash and common salt, the latter obviously derived from the turnips or mangold-wurzel, which form the staple of the food of cows. (See Analyses of Turnips, &c., in this Journal, vol. viii., part i.)

Phosphoric acid is a very minute ingredient of the liquid manure; indeed, in the examination of pure cow's urine, some chemists of great authority have been unable to detect it at all; and Baron Liebig has assumed that the whole phosphoric acid of the food finds an exit in the case of this animal by the solid excrements and the milk. Be this as it may, the quantity of the acid in liquid manure is very small, and in the use of tank-water it should never be forgotten that such is the case.

Again, as might be expected, the proportion of silica in the urine is equally minute; this substance being necessarily in great part removed from the body in the dung.

1000 gallons of *undiluted* tank-water will, according to the above analysis, contain about—

Ammonia	51 lbs.*
Potash	53 „
Phosphoric Acid, and Magnesia, each . . .	1 „

The other substances it is unnecessary to calculate.

The foregoing analysis has not been given as a correct statement of the ingredients of urine, but as a guide to the practical composition of tank-water, supposing it to be collected without dilution, and carefully preserved.

Refuse Manures.—The different manufacturing processes carried on in large towns give rise to certain waste products, which, some of them being of animal origin, and others containing one or more of the mineral ingredients considered indispensable to growing crops, will possess some value as manures. Advantage may frequently be taken of local circumstances to procure in this way a supply of particular manuring substances, at a cheaper rate than from any other source. Whilst, however, I believe that these refuse manures may be occasionally most valuable adjuncts to the ordinary resources of the farm, I feel convinced that their purchase is often a source of loss and disappointment, owing partly to mistaken ideas of their composition and value, and partly to the great variability of those which may at times be well worthy the farmer's notice. In the purchase of manures of this description one circumstance is often overlooked; namely, the expense of their conveyance. Waste manures are usually cheap, that is to say, *low priced;* and though they may really be economical when they are to be had within a few miles of home, they will seldom bear the cost of transportation. This truth must be obvious to all. It costs as much to convey a ton weight 50 miles, when its value is 1*l.*, as when it is 10*l.*; but in the one case the price is doubled, in the other increased only by 1-10th. Nor is the matter mended when the expense of carriage is nominally taken by the dealer, for the farmer may be assured that one way or the other it becomes chargeable upon the manure.

Having offered these few remarks in reference to the value of refuse substances in general, under the conviction that their importance in an agricultural point of view is often overrated, I shall proceed to give the analyses of two or three of these which have come under my attention.

Scutch.—A substance accumulates in the yards of the glue-maker and fellmonger, to which the above name is given. It is in general a mixture of hair and other animal matters with lime, partly as carbonate and partly in the caustic state. It has a smell, which is more or less offensive according to the time it has lain decomposing, and bears a price in proportion to its age.†

---

* The above will furnish the data for regulating the quantity of gypsum to be employed in a tank where this substance is used to fix the ammonia. 17 parts of ammonia require 86 parts of pure gypsum; 51 lbs. therefore (the quantity in 1000 gallons) will require 258 lbs. of the salt—in practice about 3 cwt. to 1000 gallons.

† For many years, indeed as long as I could procure it, I used Scutch for agricultural purposes extensively. I procured it immediately from the yard of the glue-

The following analyses of Scutch were made in my laboratory by Mr. Ogston. The specimen No. 1 was said to be worth 25*s.*, and No. 2 40*s.*, per ton :—

	Scutch, No. 1.	Scutch, No. 2.
Water	26·48	24·30
Animal matter and Salts of Ammonia.	12·42	32·42
Sand, &c.	18·00	6·10
Carbonate of Lime	33·19	29·98
Sulphate of Lime	7·25	3·79
Phosphate of Lime	·50	1·84
Magnesia	traces	·56
Peroxide of Iron and Aluminum	1·87	·77
Total	99·71	99·76

When examined for *nitrogen* :—

No. 1 gave ·89 Nitrogen, equal to 1·07 per cent. Ammonia.
No. 2 „ 1·57 „ „ 1·90 „ „

The only ingredients in this case to which any money value can be fairly attached, are the ammonia and the phosphate of lime. Taking the ammonia of the 2nd specimen at 2 per cent., and the phosphate of lime at the same amount, we shall in a ton obtain 45 lbs. of each of these substances.

I have elsewhere shown that ammonia may be bought in Peruvian guano for 6*d.*, and phosphate of lime in the same form for ¾*d.* per lb. We should thus have for the value of the ton of scutch—

	s.	*d.*
45 lbs. of Ammonia at 6*d.*	22	6
45 lbs. of Phosphate of Lime at ¾*d.*	2	10
	25	4

If, then, specimen No. 2 were sold at the same price as the inferior kind, whose analysis is given, the expense would be barely made good.

It is quite possible that the refuse may at times be of greater value, and to be had at a less cost than in the cases I have instanced, and its use will then be economically admissible. It should, however, be borne in mind, that 2 cwts. of Peruvian guano, at a cost of 1*l.*, would supply very nearly the same quantity of ammonia, and more of phosphate, with the advantage of a *known composition*, and requiring only one-sixth of the cartage, mixing, &c., previous to its application.

Alkali Waste.—In the manufacture of carbonate of soda from common salt, large quantities of sulphuric acid are employed for the purpose of converting the muriate into sulphate of soda. In a subsequent stage of the

---

maker in its wet state, and paid 7*s.* a waggon-load for it. I used it on various descriptions of land, red sand, clay, mountain limestone, and marl, and on all found the most beneficial results to ensue from its application. The advantage of using it was apparent not only in the first and second crops, but the parts of the fields to which this species of manure was applied were easily distinguishable by the greater luxuriance presented in the last crop of the four-course shift. It is possible that the Scutch analyzed by the learned Professor may have been subjected to a process which I understood was common some years back, viz. the abstraction of the bones from the mass left as refuse after the glue had been extracted.—W. Miles.

process this latter product is heated in a furnace with powdered chalk and coal, in which operation the sulphate of soda is changed into a mixture of carbonate and caustic alkali. When removed from the furnace the mixture is treated with water to wash out the soda. An insoluble residue now remains, containing lime and sulphur in a state of combination, which it is unnecessary to explain in the present place. It should be observed, however, that this alkali waste *when fresh* possesses caustic properties which are believed to be highly dangerous to vegetation. After a time, by exposure to the air, the whole sulphur compounds become converted into sulphate of lime, or gypsum; and the refuse can then be employed without the smallest fear to any variety of produce.

A gentleman in Wales, living near to some alkali-works, had the opportunity of purchasing a quantity of this refuse, which accumulates largely in the works, much to the annoyance of the alkali manufacturers. A specimen was sent to the laboratory, and analyzed by Mr. Ogston, with the following results:—

Analysis of Alkali Waste.

Carbonate of Lime	30·60
Sulphate of Lime	60·17
Water	2·13
Sand, &c.	3·28
Oxide of Iron, Alumina, and loss in analysis	3·82
	100·00

It might reasonably be imagined that some portion of soda would remain in the mass—such, however, was not the case; the manufacturers taking especial care to lose none of their important products. Nor, if it had been so, would it much have affected the value of the waste as manure.

Essentially, then, alkali-waste consists of sulphate and carbonate of lime, and may be used with advantage and economy wherever gypsum would be of use.

The above was purchased at the rate of 1*s.* per ton.

Woollen Refuse.—Woollen rags are well known to farmers as a powerful manure. Owing to their slow decomposition they are not well fitted for root-culture; turnips, and other plants of this kind, requiring active and readily-soluble manures to produce a rapid growth.

To wheat and to hops woollen rags are applied with the best effects. Formerly they were to be purchased of good quality and unmixed with any less valuable substance; but of late years rags of a size that used to be sold to the farmers are bought up to be re-converted into an inferior kind of cloth. The supply, being thus in part cut off, is frequently made good by the admixture of such linen or cotton rags as may not be worth the paper-maker's attention. The composition of wool in a state of purity was some years ago ascertained: it contains upwards of 17 per cent. of nitrogen. Were woollen rags, therefore, of the same strength as the wool itself, they should produce *ultimately* a larger amount of ammonia than even pure Peruvian guano.

To reason from the composition of a raw material of any kind upon that of the manufactured article which has passed through perhaps half a dozen different processes, is often to lay oneself open to much error; and nothing short of the direct analysis of the rags themselves would enable any person to form a correct notion of their manuring value.

A short time since the Earl of Tyrconnel suggested to me the desirableness of analyzing specimens of wool refuse, very justly remarking that, if they contained anything like the proportion of nitrogen which their origin would lead us to expect, they would furnish a supply of ammonia at an excessively cheap rate. His Lordship subsequently furnished the specimens, of which the analysis is given below.

Specimen No. 1.—Rags costing (at Leeds) 2*l.* per ton, and consisting of the seams and other useless parts of old cloth clothes which (from the appearance of these remnants) have been cut up, as before mentioned, to be remanufactured into cloth. To the rags are attached portions of the calico linings, together with the cotton thread used in sewing them. Of the quantity of these in relation to the cloth itself no accurate notion can be formed.

No. 2, called "premings," and No. 3, "cuttings,"* appear to be much of the same character, but totally different from the rags; they both consist essentially of coloured wool less than one-eighth of an inch in length. No. 2, "premings," is sold at 15*s.*, and No. 3, "cuttings," at 3*l.* 5*s.* per ton.

These three specimens were analyzed for nitrogen, with the following results:—

Per centage of Nitrogen in Woollen Refuse, dried at 212°.

	No. 1, Rags.		No. 2, Premings.		No. 3, Cuttings.
First experiment	11·54	..	10·49	..	13·13
Second experiment	11·21	..	10·85	..	12·81
Mean of the two experiments .	11·37	..	10·67	..	12·97

These results were afforded by the *dry* refuse. As all the specimens contain a certain quantity of water, a correction requires to be introduced in order to arrive at their value in the ordinary state:—

No. 1.—"Rags" contained . .	7·87	per cent. of Water.
No. 2.—"Premings"	7·00	„ „
No. 3.—"Cuttings"	8·70	„ „

The following table gives the quantity of nitrogen in the specimens, taken in the ordinary condition of dryness, together with the *ammonia* which, by decomposition of the animal matter, will eventually be produced.

	No. 1, Rags.		No. 2, Premings.		No. 3, Cuttings.
Per centage of nitrogen in Woollen refuse in its ordinary state of dryness	10·47	..	9·92	..	11·84
Ammonia to which the above is equal . . .	12·71	..	12·05	..	14·31

It appears, then, that it is quite incorrect to estimate the value of the different kinds of woollen refuse by the known composition of wool itself; for to whatever cause the inferiority may be due, it is plain that they do not, on the average, contain 2-3rds of the nitrogen found in the raw material. Again, it is worthy of attention that the "cuttings" and "premings," differing in composition from each other only by 2 per cent. of nitrogen, should bear a price in the relation of 4 to 1; whilst the rags, which are practically alike in composition with the "premings," are three times as costly.

I place very little stress on the relative price as of general application, inasmuch as nothing can be more capricious; but it is very evident that by a knowledge of the composition great economy may be effected; but this can only be by a special analysis of the individual sample which it is proposed to employ.

For obvious reasons the "rags" are the least desirable of the above

---

* The "cuttings" are obviously produced by the shaving process, which gives smoothness to the cloth.

specimens, being both more difficult to incorporate with the soil and of much more tardy decomposition when placed there. Where, however, the direct value cannot be ascertained by chemical analysis, it would be probably better for the farmer to purchase woollen *rags*, of the genuineness and purity of which he may form a fair notion by simple inspection, rather than those kinds which are more open to falsification.

The *price of ammonia*, as furnished by the "premings" at 15*s*. a ton, will be exceedingly moderate.

One ton of "premings" at 12 per cent. will yield 269 lbs. of ammonia for 15*s*., or less than 1¾*d*. per lb.

In guano ammonia is bought at 6*d*. a lb., so that wool-refuse affords a very cheap supply; allowance, however, being always made for the slowness with which the wool suffers decomposition. The conversion of the animal matter of the wool into ammonia may be facilitated by watering it with urine or mixing it with the dung-heap, but it will probably be always more advantageously applied to corn than as a substitute for manures containing ready-formed ammonia.

Lord Tyrconnel subsequently sent me some "shoddy," which is, I believe, the sweeping of the mills and other mixed refuse from the cloth-works—it costs 16*s*. a ton in Leeds. Upon analyzing it, Mr. Ogston found that in its original state it contained—

	Per centage of Nitrogen.	
By the first experiment . . .	4·43	
By the second experiment . .	4·68	
Mean of the two experiments .	4·55	equal to 5·52 of Ammonia.

It contained 6·11 per cent. of water.

Shoddy, if we may judge by this specimen, is not half so valuable a manure as the other woollen matters. As it is excessively full of oil, it was thought worth while to ascertain whether the quantity of this ingredient was adequate to explain the low per centage of nitrogen. The shoddy, when treated with ether, gave 26·36 per cent. of oil, containing some colouring matter. The presence of one-fourth of its weight of oil does not, therefore, sufficiently account for the inferiority.

The above results are borne out by an analysis which some time since was made in this laboratory of some wool-refuse for the Rev. A. Huxtable, with the following result:—

Analysis of Inferior Wool-Refuse from Mr. Huxtable.

Water	7·15
Animal Matter and Oil	58·52
Phosphate of Lime	1·48
Oxide of Iron and Alumina	2·10
Carbonate of Lime	9·42
Sand, &c.	21·23
Alkaline Salts and loss in analysis . . .	·10
	100·00

Analyzed for nitrogen, the above afforded about 2·5 per cent., or less than that in the specimen of shoddy before described.

The per centage of *pure* ash in woollen refuse is not great, and the ingredients of the ash are of small agricultural value. One of the above specimens when burned afforded 10·12 per cent. of ash, principally clay and sand, and of the mineral matter only ·44 per cent. was found to be phosphoric acid.

Worthless and Inferior Manures.—The adulteration of manures of real value, and the sale of others possessing little or no fertilizing power, is a matter of common notoriety at the present day. In spite, however, of all that has been said or written on this subject, farmers persist in purchasing from dealers, of whom they know little or nothing, manures of which they know even less. To those who have any faith in *composition* as the test of manurial efficacy, I offer the following analyses as specimens of the kind of *stuff* to which, under the plea of *economy*, many are content to intrust the success of their crops.

The first analyses, No. 1 and No. 2, are those of so-called "animal guano," offered for sale by the same dealers to two gentlemen on different occasions; No. 1 at 5*l.*, and No. 2 at 4*l.* a ton. They consisted respectively of

	No. 1.	No. 2.
Water	1·95	3·43
Organic Matters	26·23	32·43
Sand	9·68	28·35
Oxide of Iron, Alumina, with a little Phosphoric Acid . .	5·40	6·29
Carbonate of Lime	43·57	15·30
Sulphate of Lime	2·80	11·97
Caustic of Lime	4·26	. .
Common Salt and loss in analysis	6·11	. .
	100·00	100·77

When analyzed for *nitrogen*—

No. 1 gave . . 1·62 per cent., equal to 1·97 per cent. of ammonia.
No. 2 gave . . 1·61 per cent., equal to 1·96 per cent. of ammonia.

Practically these, no doubt, were one and the same substance. The analysis closely resembles that of scutch (Specimen No. 2); and the "animal guano" was, in all probability, that article. I have already said that scutch cannot be, on any showing, worth *more* than 25*s.* a ton; and consequently the purchaser of either of the above specimens would be defrauded of three-fourths of the sum paid for them.

The next analyses are those of two specimens of manure purchased by a gentleman in Yorkshire:—

	No. 3.	No. 4.
Water	27·61	27·57
Organic Matter	26·60	25·20
Sand	9·02	9·00
Phosphate of Lime	7·98	14·62
Oxide of Iron and Alumina .	4·71	
Sulphuric Acid	13·73	10·23
Lime	5·33	5·45
Magnesia	·23	. .
Common Salt	3·77	. .
Free Sulphur	. .	3·78
Loss	1·02	4·15
	100·00	100·00

The *nitrogen* was as follows:—

In No. 3 . . . . ·78 per cent. = ·96 per cent. of ammonia.
In No. 4 . . . 1·65 per cent. = 2·01 per cent. of ammonia.

These were samples from the same manure, purchased at different times. Although possessing a quality which farmers much like, that is to say, a very offensive smell, there is evidently nothing to justify the price of 4*l.* per ton which was charged for them—their *outside* value, in relation to standard manures, being from 25*s.* to 30*s.*

I will conclude this list by the analyses of two specimens of manure which exceed the former in price, while they fall short, if possible, of them in value.

The first of these, No. 5, is a manure of which, by the talents and perseverance of its originators, a very considerable amount was disposed of in the neighbourhood of Leeds, as well as in more distant markets. The second (No. 6) was sold as a "tillage for turnips," bearing the dealer's name.

The following will give the idea of their value :—

	No. 5.	No. 6. "Tillage for Turnips."
Water	31·34	4·93
Sand and Clay	8·96	74·16*
Organic Matter	15·30	4·43
Phosphate of Lime	·40	trace.
Oxide of Iron and Alumina . .	7·94	13·88
Carbonic Acid	2·23	trace.
Sulphuric Acid	3·80	none.
Lime	6·88	1·05
Common Salt	9·94	1·62
Substances not determined, and loss	13·21	. .
Total	100·00	100·07

* Including 12·06 soluble silica.

No. 5, analyzed for nitrogen, gave ·5 per cent., equal to ·6 per cent. of ammonia.

The first of these "*manures*" was sold at 7*l.* 10*s.* per ton; the second, at 8*l.* per ton. The "tillage" is nothing more nor less than a red soil (probably of the new red-sandstone formation) broken down into a tolerably fine powder, the dealer not having even troubled himself to disguise its real character by the addition of any known manuring substance.

No wonder that "no beneficial results were obtained from its trial."

I shall take leave of this subject with the expression of my belief that thousands of pounds are annually wasted upon such rubbish without the smallest return; which, employed to purchase a *smaller amount* of standard, recognised fertilizers, would be amply returned to the farmer's pocket.

XXXI.—*On the Blocking-up of Drains by the Roots of Mangold.* By Mr. MOORE.

To Mr. Pusey.

DEAR SIR,—The specimen of mangold-wurzel roots which I showed you at Pusey a short time since, and which at your request I purpose taking to London the second week in December, was taken from a drain constructed of two large horseshoe tiles (6 inches by 3 inches), and placed in the land at an average depth of about 27 inches. This drain was made some thirty years ago to convey water to the farmhouse, and, consequently, there is a constant stream flowing along its channel; the whole of the field across which the drain passes has recently been thorough-drained, and in the month of September, the water having ceased to flow into the trough at the farm-buildings, a man was sent to examine the ground to discover if there was any appearance on the surface of the drain being stopped; not finding any, he was directed to open the drain in a few places. Not being acquainted with its exact course, he opened on a place where the mangold-wurzel leaves appeared darker than the general crop, and on reaching the drain at a depth of about 3 feet 6 inches it proved not to be the water-drain already referred to, but one of the main drains laid down in the winter of 1847. This drain (size 4½ inches by 3 inches) was not stopped, the water running freely (after the early rains we had in the autumn), but there was a mass of fibrous roots formed in the bottom tile about 2 inches deep and 1½ in width, very similar to what I showed you, though much more white and delicate. After having satisfied myself, both by tracing the roots from the surface and tasting those in the drain, that it was really from the mangold-wurzel above, we proceeded to examine the water-drain, and had no difficulty in finding its course, as the leaves of the wurzel were so decidedly dark and luxuriant, more so than in the former case. On arriving at the drain it was found completely choked with these roots, and the water was totally stopped and forced out at the joints of the tiles in another part of the drain. There can by no possibility be any mistake about the matter, as the piece of mangold-wurzel was about 6 chains wide (4 acres), and on either side potatoes and swedes; and directly we were off the land on which the wurzel was growing, the appearance of roots in the drain altogether ceased. The impression produced on my own mind is this: that mangold-wurzel will always be liable to stop drains along which water continually flows, but not otherwise, because, generally speaking, in dry summers there will be no water in drains on strong or clay soils to attract its roots, and in wet seasons, or, as they are often designated hereabouts, "dropping seasons," the plants would always have sufficient moisture in the active or cultivated soil, and therefore would not be tempted to penetrate into the uncongenial strata below. I think it may be accounted for, with reference to the roots having gone down into the main drain first referred to, by the fact of its being so recently laid; the land was hollow, and a good deal of the top soil had been mixed with subsoil; no doubt, from the appearance of the plants, they had found nourishment on their way, as well as in the drain. I should therefore say it would be wise to wait a few years before growing mangold-wurzel on recently drained land.

Between this and the Society's meeting in December I purpose having a few drains examined where we have grown large crops of mangold-wurzel since they were drained, and if any injury has been done I will communicate it to yourself or at the meeting.

I am, Sir, your obedient servant,
E. W. Moore.

Coleshill, November 19, 1849.

P.S.—I may add, that in the furrow-drains (pipes $1\frac{3}{8}$-inch bore) no fibres had penetrated, though here and there traces of roots were found underneath the pipes. In the water-drain the whole extent of the drain across the mangold-wurzel land was filled.

END OF VOL. X.

PRINTED BY W. CLOWES AND SONS, STAMFORD STREET.

Royal Agricultural Society of England.

1848—1849.

President.

THE EARL OF CHICHESTER.

Trustees.

Acland, Sir Thomas Dyke, Bart., M.P.
Braybrooke, Lord
Clive, Hon. Robert Henry, M.P.
Graham, Rt. Hon. Sir Jas., Bart., M.P.
Lawley, Sir Francis, Bart.
Neeld, Joseph, M.P.
Portman, Lord
Pusey, Philip, M.P.
Richmond, Duke of
Rutland, Duke of
Spencer, Earl
Sutherland, Duke of

Vice-Presidents.

Barker, Thomas Raymond
Chichester, Earl of
Downshire, Marquis of
Ducie, Earl of
Egmont, Earl of
Exeter, Marquis of
Fitzwilliam, Earl
Gooch, Sir Thomas Sherlock, Bart.
Hardwicke, Earl of
Hill, Viscount
Wellington, Duke of
Yarborough, Earl of

Members of Council.

Austen, Colonel
Barnett, Charles
Bennett, Samuel
Blanshard, Henry
Booth, John
Bramston, Thomas William, M.P.
Brandreth, Humphrey
Burke, J. French
Challoner, Colonel
Childers, John Walbanke, M.P.
Denison, John Evelyn, M.P.
Druce, Samuel
Foley, John H. H., M.P.
Garrett, Richard
Gibbs, B. T. Brandreth
Grantham, Stephen
Hamond, Anthony
Hatherton, Lord
Hillyard, C.
Hobbs, William Fisher
Howard, Hon. Captain Henry, M.P.
Hudson, George, M.P.
Hudson, John
Hyett, William Henry
Johnstone, Sir John V. B., Bart., M.P.
Jonas, Samuel
Kinder, John
Lawes, John Bennet
Leicester, Earl of
Lemon, Sir Charles, Bart., M.P.
Miles, William, M.P.
Milward, Richard
Pelham, Hon. Captain Dudley, R.N.
Pendarves, Edward W. Wynne, M.P.
Price, Sir Robert, Bart., M.P.
Pym, Francis
Ridley, Sir Matthew White, Bart.
Sewell, Professor
Shaw, William
Shaw, William, junior
Shelley, John Villiers
Slaney, Robert Aglionby, M.P.
Smith, Robert
Stansfield, W. R. Crompton, M.P
Stokes, Charles
Thompson, Henry Stephen
Turner, George
Webb, Jonas
Wilson, Henry

Secretary.

JAMES HUDSON, 12, *Hanover Square, London.*

Consulting-Chemist—JOHN THOMAS WAY, 23, Holles Street, Cavendish Square.
Consulting-Engineer—JAMES EASTON, or C. E. AMOS, The Grove, Southwark.
Seedsmen—THOMAS GIBBS & Co., Corner of Halfmoon Street, Piccadilly.
Publisher—JOHN MURRAY, 50, Albemarle Street.
Bankers—H., A. M., C., A. R., G., and H. DRUMMOND, Charing-Cross.

Honorary Members.

AUSTRIA, His Imperial Highness, The Archduke John of.

BUCKLAND, The Very Rev. WILLIAM, D.D., Dean of Westminster.

CARR, Captain J. STANLEY.

COLMAN, HENRY, Agricultural Commissioner of the State of Massachusetts.

DAUBENY, CHARLES, M.D., Professor of Rural Economy, University of Oxford.

DE LA BECHE, Sir HENRY THOMAS, Director of the Ordnance Geological Survey.

EVERETT, The Hon. EDWARD, President of Cambridge University, U. S.

GRAHAM, THOMAS, Professor of Chemistry, University College, London.

HENSLOW, The Rev. J. S., Professor of Botany, University of Cambridge.

HOFMANN, Dr., Professor of Chemistry, Royal College of Chemistry, London.

JOHNSTON, JAMES F. W., Reader in Chemistry, University of Durham.

LIEBIG, Baron, University of Giessen.

MURCHISON, Sir RODERICK I., K.S.P., President of the Royal Geographical Society.

PARKES, JOSIAH, C.E., 11, Great College Street, Westminster.

PLAYFAIR, Dr. LYON, Chemist to the Ordnance.

SIMONDS, JAMES BEART, Lecturer on Cattle Pathology, R. Veterinary Coll., London.

SOLLY, EDWARD, Professor of Chemistry, Hortic. Society, and Addiscombe College.

SPRENGEL, Dr. CHARLES, Secretary to the Pomeranian Agricultural Society.

STEVENSON, The Hon. ANDREW, Washington.

VAN DE WEYER, M. SYLVIAN, Belgian Minister.

WAY, JOHN THOMAS, Consulting-Chemist to the Society.

Royal Agricultural Society of England.

GENERAL MEETING,

12, Hanover Square, Tuesday, May 22, 1849.

REPORT OF THE COUNCIL.

The Council have to report to the Members at their present General Meeting, that during the past half-year 3 Governors and 226 Members have been elected into the Society, 3 Governors and 35 Members have died, and the names of 6 Governors and 893 Members have been, on various accounts, omitted from the list of the Society, which accordingly now comprises—

89 Life Governors,
178 Annual Governors,
582 Life Members,
4643 Annual Members, and
20 Honorary Members.

They think it, however, right to remark that, in the list of names which have been erased from the books of the Society, are included, not only those of Members who, for various reasons in the course of things, have signified their desire to withdraw; but a much larger number, who, with reference to the transactions of former years, have ceased to belong to the Society. A corrected list of the Governors and Members will be printed at the end of the Volume of the Journal for the present year.

The Council have elected Mr. Thomas Raymond Barker a Vice-President of the Society, in the place of the Earl Talbot, deceased; and Mr. Henry Blanshard, a General Member of the Council, to supply the vacancy created in that body by the transfer of Mr. Barker's name to the list of the Vice-Presidents. They have also elected Professor Simonds an Honorary Member of the Society.

By the sale of 1000*l*. Stock out of the invested capital of the Society, and the application of a portion of the current cash balance in the hands of their Bankers, they have been enabled to pay off the loan contracted with Messrs. Drummond in the autumn of last year; and they have received from the Chairman of the Finance Committee an intimation that previously to the ensuing Country Meeting, the Committee will be fully prepared to report in detail the result of their investigations into the whole financial condition of the Society, both in reference to points in which the expenditure may be submitted to judicious control, and to measures by which the income of the Society may be relieved from the inconvenience arising from unpaid arrears of subscription.

The Council receive with the highest satisfaction the continued assurance of the increasing value of the Journal of the Society; and it is a most gratifying fact, that out of an issue by post of upwards of 5000 copies of the last part, addressed to Members residing in remote localities in the kingdom, only one instance of miscarriage has been complained of. They cannot but regard the combination of these most important circumstances, namely, the increased value of the work and the facilities for its mechanical transmission, as calculated very essentially to effect the diffusion of sound practical knowledge among their Members, and through them among the agricultural community in general. They have decided, that the price of the Journal to non-members shall henceforward be ten shillings for each part, instead of six shillings as heretofore.

The Council, feeling the essential importance of calling in the direct aid of science for the purpose of effecting a decided advancement in the great object of improved cultivation, by the development of the latent energies of the soil, and a more exact knowledge of the sustenance required by or taken up by plants, have, after mature deliberation, agreed to the following Report of their Chemical Committee, in the hope that while an immediate personal privilege is conferred by it on the Members of the Society, a decisive step will have been taken for the attainment of the more remote, but not less certain advantages resulting from a well-organized system of chemical research, on questions connected with the mutual relations of the plant and soil, and from analytical investigations into the composition and value of substances produced by the farmer or employed in his operations.

" REPORT OF THE CHEMICAL COMMITTEE.

" The Committee recommend that in future the privilege of obtaining analyses of manures, agricultural products, and soils, at the following reduced rates, be made a privilege of all Members of the Society.

" No. 1. An opinion as to the genuineness of a manure in the market, 7*s.* 6*d.* By this is meant such an opinion as could be formed by a scientific person, by inspection, with a few simple confirmatory experiments.—[It will protect from fraud, but is not calculated to assist materially in the choice of the *best* specimens, where all are *genuine;* it will inform the applicant whether a specimen of guano or oilcake, for instance, be adulterated or not; but will not touch the question of its relative value as a pure specimen. Such an opinion will only apply to ordinary market articles, as guano, oilcake, superphosphate of lime, sulphate of ammonia, gypsum, common salt, &c.] No. 2. Guano. A determination of the nitrogen (ammonia), or of the same and of the earthy phosphates, &c., 1*l.* The following is an instance, taken at random, of such an analysis:—Water, 17·95; organic matter and ammonial salts, 51·39; sand, &c., 1·34; earthy phosphate, principally phosphate of lime, 20·98; alkaline salts, and loss to make up the difference, often consisting of common salt, &c., 8·34: total, 100·00. This is all that is needed to give the agricultural value of guano, or a close approximation to it. No. 3. Limestone. The proportion of lime, 7*s.* 6*d.*; the proportion of magnesia, 10*s.*; the proportion of lime and magnesia, 15*s.* This analysis is sufficient for many purposes; but in most limestones, sulphur, lime, phosphorus, and magnesia are present. The next analysis is better for farmers, inasmuch as it is impossible to say how much of the effect may be due to *minute* ingredients. No. 4. Limestone, or Marls, including carbonates, phosphates, sulphate of lime, and magnesia, with sand and clay, 1*l.* No. 5. Partial analysis of a soil, including sand, clay, organic matter, and carbonate of lime, 1*l.* No. 6. Complete analysis of soil, 3*l.* No. 7. Letter, asking advice, *one* topic, 7*s.* 6*d.* On more than one topic, 10*s.* No. 8. Oilcake, or dung, or any animal products (such as cheese or butter in milk), nitrogen, and phosphoric acid, 1*l.* Oilcake, including nitrogen, oil, and phosphoric acid, 30*s.*

"That a salary of 200*l.* a-year be paid to Professor Way for this purpose, and that the Committee have further power to expend a sum not exceeding 300*l.* a-year in such chemical inquiries for the Journal as the Council shall yearly direct, on consideration of the report made by the Chemical Committee."

The Council have decided that the ensuing Country Meeting of the Society, at the city of Norwich, shall be held in the week commencing Monday the 16th of July, the Thursday, as formerly, being the principal day of the Show; and they have the satisfaction of reporting that, great as was the number of implements exhibited at the York Meeting of last year over the entries on any former occasion, the number entered for exhibition and trial at the ensuing Norwich Meeting exceeds that amount by a very considerable number. They have received from the principal railway companies throughout the kingdom a grant of the same liberal concessions in favour of the Society's exhibitors as was made by them last year, namely, the free conveyance of live stock, and a reduction of one-half the usual rates of charge for implements, on proceeding to the Show, and with similar concessions on returning from it, provided the animals or implements are unsold and remain *bonâ fide* the property of the respective exhibitors. The authorities of Norwich have granted the free use of St. Andrew's Hall, fitted up at their own expense, for the purposes of the Great Dinner of the Society, and of the Council Dinner; and Professor Simonds, and the Rev. Edwin Sidney, have kindly consented to deliver Lectures before the Members on the occasion of their meeting in that city—the former, "On the Diseases of the Organs of Respiration, with particular reference to Pleuro-Pneumonia, in the Ox;" the latter, "On the Parasitic Fungi of the British Farm." It has been decided that the Country Meeting of the Society for the Western District shall be held next year at the city of Exeter; and that the District for the year 1853 shall be comprised of the counties of Leicester, Lincoln, Nottingham, and Rutland, and be designated the East-Midland District.

The Council have the satisfaction of receiving from their Journal Committee the most favourable report of the number and value of the Essays competing for the Society's prizes of the present year. They believe that the spirit of inquiry thus aroused on so many important topics of practical interest will lead to that continued progress in the improvement of agricultural economy, in all its branches, which it has hitherto been the great object of the Society to promote. But while they regard the stimulus of honorary distinctions and pecuniary rewards, the collection and dissemination of important facts, and the communication of personal experience among farmers themselves at the Council Meetings in London, and at the Country Meetings held in successive districts of the kingdom, as most effective means for the extension of agricultural knowledge; they rely with the greatest confidence on the friendly co-operation of the owners and occupiers of land, for devising and carrying out, to their mutual advantage and the common good of the country, the most approved systems for the cultivation of the soil, and the best measures for promoting the comfort and welfare of those who depend upon it for their support.

In conclusion, they beg to remind the Members of the Society that the Council Meetings, on the first Tuesday in each month, are set apart for the strictly official business of the Society, in order that the Meetings on the other Tuesdays of the month may be devoted to the consideration and discussion of such communications of a practical nature as may from time to time be made to them; and they are desirous to make it extensively known that every Member of the Society has the privilege of attending such three Weekly Meetings of the month, and has it in his power to contribute, by his participation in their proceedings, to the common interest of the parties present, as well as to the gradual promotion of the several objects of the Society.

By order of the Council,

(Signed) JAMES HUDSON,
Secretary.

London, May 18, 1849.

REPORT OF THE CHEMICAL COMMITTEE, 5 *June*, 1849.

THE Chemical Committee have considered the charges for the different subjects of analysis, and have seen no reason for any material alteration in the scale, which stands as follows:—

No. 1. An opinion as to the genuineness of a manure in the market, 7*s.* 6*d.* By this is meant such an opinion as could be formed by a scientific person, by inspection, with a few simple confirmatory experiments.—[It will protect from fraud, but is not calculated to assist in the choice of the best specimens, where all are genuine: it will inform the applicant whether a specimen of guano or oil-cake, for instance, be adulterated or not; but will not touch the question of its relative value as a pure specimen. Such an opinion will only apply to ordinary market articles, as guano, oil-cake, superphosphate of lime, sulphate of ammonia, gypsum, common salt, &c.] No. 2. Guano. A determination of nitrogen (ammonia) and of the earthy phosphates, &c., 1*l.* No. 3. Limestone. The proportion of lime, 7*s.* 6*d.*; the proportion of magnesia, 10*s.*; the proportion of lime and magnesia, 15*s.* This analysis is sufficient for many purposes; but in most limestones the phosphate and sulphate of lime, and magnesia, are present, though in small proportions; and inasmuch as it is impossible to say how much of the effect may be due to other minute ingredients, it is recommended that their quantity should always be determined. No. 4. Limestone, or marls, including carbonate, phosphate, and sulphate of lime, and magnesia, with sand and clay, 1*l.* No. 5. Partial analysis of a soil, including sand, clay, organic matter, and carbonate of lime, 1*l.* No. 6. Complete analysis of a soil, 3*l.* No. 7. Letter asking advice, one topic, 7*s.* 6*d.* On more than one topic, 10*s.* No. 8. Oil-cake, or dung, or any animal products, nitrogen, and phosphoric acid, 1*l.* Oil-cake, including nitrogen, oil, and phosphoric acid, 1*l.* 10*s.* They have also added a ninth subject, namely, No. 9. A determination of the quantity of carbonate and sulphate of lime in any specimen of water, 1*l.*

They recommend a grant of 300*l.* for the ensuing year, to be apportioned in the following manner:—A sum not exceeding 100*l.* for an account of analyses of guano (a paper on which subject is nearly completed). 2. A sum not exceeding 100*l.* for an account of analyses of oil-cake and linseed, with reference to the nutritive qualities of different specimens. 3. A sum not exceeding 100*l.* for an account of analyses of chalk and marls used in top-dressings.

"The Committee further recommend that when Mr. Way is applied to for an analysis he shall inform the applicant the cost of such analysis, together with the cost of carriage of any specimen sent up, and shall not be authorized to make such analysis until the amount due shall be sent to him.

"That a printed copy of this resolution be sent to every member applying for an analysis."

(Signed) PHILIP PUSEY, *Chairman.*

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

Half-yearly Account ending the 31st of December, 1848.

RECEIPTS.

	£.	s.	d.
Balance in the hands of the Bankers, 1st July, 1848	1294	13	9
Balance in the hands of the Secretary, 1st July, 1848	12	10	3
Loan by the Bankers of the Society	1500	0	0
Sale of Stock from the invested capital of the Society	877	10	0
Dividends on Stock	156	0	2
Life Compositions of Members	148	0	0
Annual Subscriptions of Governors	150	0	0
Annual Subscriptions of Members	1990	6	0
Sale of Journal	144	12	6
Sale of Cottage Tracts	1	10	11
Sale of Duplicate Books	15	15	6
Grant of Yorkshire Agricultural Society*	350	0	0
General receipts during the half-year, on account of Country Meetings	190	15	2
	£6831	14	3

(Signed) C. B. CHALLONER, *Chairman*,
THOMAS RAYMOND BARKER,
THOMAS AUSTEN,
HENRY BLANSHARD,
} *Finance Committee.*

PAYMENTS.

	£.	s.	d.
Repayment of Loan	1500	0	6
Interest on Loan	25	6	8
Permanent Charges	278	12	6
Taxes and Rates	17	1	2
Establishment	420	14	4
Postage and Carriage	34	10	11
Advertisements	6	10	6
Expenses of Journal	327	5	3
Analysis of Ashes of Plants	150	0	0
Award of Prizes offered by the Society	1502	19	6
Two Prizes for Reports on the Farming of Yorkshire	100	0	0
Payments during the half-year on account of Country Meetings	1864	2	2
Miscellaneous Items of Petty Cash	6	0	9
Balance in the hands of the Bankers, 31st December, 1848	588	7	1
Balance in the hands of the Secretary, 31st December, 1848	10	3	5
	£6831	14	3

Examined, audited, and found correct, this 18th day of May, 1849.

(Signed) C. H. TURNER,
THOMAS KNIGHT,
ROBERT BEMAN,
} *Auditors on the part of the Society.*

---

* For the convenience of the parties to whom this amount was awarded in Local Prizes, the cheques were drawn on the Society's Bankers at York, and paid by them out of a portion of the balance they would otherwise have had to transmit to the Society's Bankers in London, when the amount would in that case have appeared on both sides this balance-sheet.

Essays and Reports.

I. AWARDS MADE IN 1849.

To Clare Sewell Read, of Kilpaison, near Pembroke, the prize of Fifty Sovereigns, for the best Report on the Farming of South Wales.

To Thomas Rowlandson, of Greek Street, Liverpool, the prize of Twenty Sovereigns, for the best Report on the Breeds of Sheep best suited to different localities, respectively with reference to soil, climate, elevation, and mode of farming.

To Thomas Rowlandson, of Greek Street, Liverpool, the prize of Fifteen Sovereigns, for the best Essay on Top-dressing of Soil with Mineral Substances.

To William James Garnett, of Bleasdale Tower, near Garstang, the prize of Fifty Sovereigns, for the best Report on the Farming of Lancashire.

To John Farncombe, of Patriot Place, Brighton, the prize of Fifty Sovereigns, for the best Report on the Farming of Sussex.

To Thomas Rowlandson, of Greek Street, Liverpool, the prize of Twenty Pounds, for the best account of the Breeding and Management of Pigs.

To Hall W. Keary, of Holkham, Norfolk, the prize of Fifteen Sovereigns, for the best Report on the Management of Barley.

To John Chalmers Morton, of Whitfield Farm, Gloucestershire, the prize of Fifty Sovereigns, for an account of the best method of increasing the existing supply of Animal Food.

To Henry Goddard, Architect and Surveyor, Lincoln, the prize of Fifty Sovereigns, for the best Essay on the Construction of Labourers' Cottages.

To John Young Macvicar, of Barkwith House, Wragby, the prize of Twenty Sovereigns, for the second-best Essay on the Construction of Labourers' Cottages.

II. PRIZES OFFERED FOR 1850.

All Prizes of the Royal Agricultural Society of England are open to general competition.

⁂ *Competitors will be expected to consider and discuss the heads enumerated.*

I. FARMING OF LINCOLNSHIRE.

FIFTY SOVEREIGNS will be given for the best Report on the Farming of Lincolnshire.

1. Character of the soils of the county, especially of its marsh and fen lands.
2. The peculiarities, whether advantageous or defective, in its agricultural management.
3. The drainage of the county in a general view and the improvements which may yet be effected therein, especially by effecting natural instead of artificial drainage.
4. The management of the farm-yard, with the advantages and disadvantages of putting up the ricks at one central homestead.
5. The suitability or otherwise of the present long-woolled breed of sheep to the ranges of light turnip land in the county.
6. The desirableness or otherwise of increasing the proportion of Swedes in the turnip crop for spring consumption.
7. The grounds of the present practice in consuming the straw with oil-cake given to beasts on light arable farms.
8. The comparative merits of rape and turnips on peaty land, and the best mode of growing and feeding off rape.
9. The condition of the labourer and the improvement required therein, by bringing his dwelling nearer to his place of labour.

II. FARMING OF SOMERSETSHIRE.

FIFTY SOVEREIGNS will be given for the best Report on the Farming of Somersetshire.

1. The soils of the county.
2. The peculiarities, advantageous or otherwise, in its farm management.
3. The general drainage of the Bridgewater and other levels, and the improvement yet required in the outfalls.
4. The degree to which the cultivation is injured by small inclo-

sures and hedge-row timber, and the extent to which they ought to be removed, unless in high situations, where they may be required for shelter.

5. The causes and remedies for the foulness of arable land, whether with couch or rootweeds.
6. The defective cultivation of the turnip crops, and the best mode of management, keeping in view the peculiar moisture of the climate.
7. The advisability or otherwise of abandoning the alternate system of arable and grass cultivation in the western parts of the county.
8. The quality of the soil on the moor-lands, and the advisability of bringing them into cultivation, with any instances of success in such improvements.
9. The formation of catch-meadows in valleys or on mountain sides, according to the cheapest methods, with an account of the improved value thus given to the land so employed.
10. The state of the labourers as to employment, with the means of increasing it, and as to their habitations.

III. ABORTION IN COWS.

THIRTY SOVEREIGNS will be given for the best Report on Prevention of Abortion in Cows.

1. The extent of its prevalence.
2. The causes thereof.
3. The means of prevention.

IV. DISEASES OF CATTLE AND SHEEP OCCASIONED BY MISMANAGEMENT.

THIRTY SOVEREIGNS will be given for the best Essay on the Diseases of Cattle and Sheep occasioned by Mismanagement.

1. Insufficient food in different stages of growth.
2. Insufficient shelter and exposure to rain and cold.
3. Insufficient drainage of soil.
4. Carelessness of shepherds and feeders.
5. Inattention to contagiousness of disorders.
6. Inattention to first symptoms of disorders.

V. MANAGEMENT OF OATS.

TWENTY SOVEREIGNS will be given for the best Essay on the Management of Oats.

1. Soil best adapted to oats.
2. Whether the effect of the cooler climate of Scotland in producing superior oats can be compensated in the southern parts of the island by any improvement of cultivation.
3. Different varieties as suited to different situations and different purposes.
4. General management.

VI. REARING AND MANAGEMENT OF POULTRY.

TWENTY SOVEREIGNS will be given for the best Essay on the Rearing and Management of Poultry.

1. Construction of poultry-house.
2. Rearing young broods of fowls, ducks, geese, turkeys, and Guinea-fowls.
3. Limit, if any, of numbers, in proportion to size of farm.
4. Different kinds of food.
5. Different varieties or breeds.
6. Best mode of fattening according to the received practice of districts which afford the chief supply of each kind of poultry to the London market.

VII. CLIMATE OF BRITISH ISLANDS IN ITS EFFECT ON CULTIVATION.

FIFTY SOVEREIGNS will be given for the best Essay on the Climate of the British Islands in its effect on Cultivation.

1. Increase of winter cold in passing from south to north, and from west to east.
2. Different distribution of heat in the various seasons of the year,
3. Different amount of *insensible* vapour in the atmosphere on the western and eastern sides of England and Ireland.
4. Different amount of *sensible* moisture or fogs.
5. Different degree of general cloudiness of the sky.
6. Different annual quantity of rain, and difference in the distribution of rain, with the signs of its approach.

7. Effect of elevation on temperature and lateness of harvest, with the highest level for the growth of corn in different latitudes.
8. Effect of climate on the growth of grass, the different kinds of corn and roots, fruit and timber trees.
9. The situations in Great Britain and Ireland proved by experience to be best suited for each kind of agricultural produce and stock.
10. How far it is desirable to adopt the regular four-course arable system on the western sides of England and Ireland, the same being naturally fitted for the spontaneous growth of grass.

N.B. It is not expected that competitors should necessarily answer the whole of these questions, which in the present state of agricultural meteorology would be unreasonable to require.

VIII. DESTRUCTION OF WIREWORM.

FIFTY SOVEREIGNS will be given for the best Essay on the Destruction of the Wireworm, provided the proposed remedy be founded on practical grounds.

These Essays must be sent to the Secretary, at 12, *Hanover Square, London, on or before March* 1*st*, 1850.

⁂ Contributors of Papers are requested to retain Copies of their Communications, as the Society cannot be responsible for their return.

RULES OF COMPETITION FOR PRIZE ESSAYS.

1. All information contained in Prize Essays shall be founded on experience or observation, and not on simple reference to books or other sources.

2. Drawings, specimens, or models, drawn or constructed to a stated scale, shall accompany writings requiring them.

3. All competitors shall enclose their names and addresses in a sealed cover, on which only their motto, and the subject of their Essay, and the number of that subject in the Prize List of the Society, shall be written.*

4. The President or Chairman of the Council for the time being shall open the cover on which the motto designating the Essay to which the Prize has been awarded is written, and shall declare the name of the author.

5. The Chairman of the Journal Committee shall alone be empowered to open the motto-paper of such Essays, not obtaining the Prize, as he may

---

* Competitors are requested to write their motto on the Paper on which their names are written, as well as on the envelope.

think likely to be useful for the Society's objects, with a view of consulting the writer confidentially as to his willingness to place such paper at the disposal of the Journal Committee.

6. The copyright of all Essays gaining prizes shall belong to the Society, who shall accordingly have the power to publish the whole or any part of such Essays; and the other Essays will be returned on the application of the writers; but the Society do not make themselves responsible for their loss.

7. The Society are not bound to award a prize unless they consider one of the Essays deserving of it.

8. In all reports of experiments the expenses shall be accurately detailed.

9. The imperial weights and measures only are those by which calculations are to be made.

10. No prize shall be given for any Essay which has been already in print.

11. Prizes may be taken in money or plate, at the option of the successful candidate.

12. All Essays must be addressed to the Secretary, at the house of the Society.

General Meetings of 1849-50.

The General December Meeting, in London, on Saturday, December 15, 1849.

The General May Meeting, in London, on Wednesday, May 22, 1850.

The Annual Country Meeting, at Exeter, in 1850.

Annual Subscriptions.

Subscriptions may be paid to the Secretary, in the most direct and satisfactory manner, either at the Office of the Society, No. 12, Hanover-Square, London, between the hours of ten and four, or by means of Post-Office orders, to be obtained on application at any of the principal Post-Offices throughout the kingdom, and made payable to him at the General Post-Office, London; but any cheque on a London banker, or other house of business in London, will be equally available, if made payable on demand. The subscriptions are due in advance for each year on the 1st of January, and are in arrear if unpaid by the 1st of June ensuing. No Member is entitled to the Journal, or to any other privileges of the Society, whose subscription is in arrear.

ELECTION, &c., OF MEMBERS.

Nomination.—Every candidate for admission into the Society must be proposed by a Member; the proposer to specify in writing the name, rank, usual place of residence, and post-town, of the candidate, either at a Council, or by letter to the Secretary. Every such proposal shall be read at the Council at which such proposal is made; or, in the case of the Candidate being proposed by a letter to the Secretary, at the first meeting of the Council next after such letter shall have been received.

Election.—At the next Meeting of the Council the election shall take place, when the decision of the Council shall be taken by a show of hands; the majority of the Members present to elect or reject. The Secretary shall inform Members of their election by a letter, in such form as the Council may from time to time direct.

Payments.—1. Annual.—The subscription of a Governor is 5*l.* and that of a Member 1*l.*, due in advance on the 1st of January of each year, and becoming in arrear if unpaid by the 1st of June. Members elected in November or December may date the commencement of their liabilities and privileges with the Society from the 1st of January in the ensuing year. 2. For Life.—Governors may compound for subscription during future life by paying at once the sum of 50*l.*, and Members by paying 10*l.* No Governor or Member in arrear of subscription can be allowed to enter into composition for life until such arrears have been paid.

Privileges.—The Journals of the Society for the year during which their subscription has been paid, transmitted by post, free of charge, to their address; analyses performed at a reduced charge by the consulting chemist; the liberty of attending all weekly Meetings of the Council in London, and of consulting the books in the library; free entry of stock, and priority of claim for dinner and lecture tickets at the Country Meetings of the Society. No Member in arrear of his subscription is entitled to any of the privileges of the Society.

Liabilities.—All Members belong to the Society, and are bound to pay their annual subscriptions, until they shall withdraw from it by a notice in writing to the Secretary.

Resignation.—Members can only withdraw their names legally from the Society by a written notice to the Secretary, and the payment of all subscriptions due from them at the date of such notice.

Expulsion.—Members may be dismissed from the Society in the following manner:—Any ten Members of the Society may send, in writing, signed by their names, to the Council, a request that any Member of the Society shall be dismissed from the Society. Such request shall be placed in a conspicuous part of the Council-room, and a copy thereof transmitted by the post to the Member proposed to be so dismissed, signed by the Secretary. At the monthly Meeting of the Council which shall take place next after one month shall have elapsed after such request shall have been placed in the Council-room, the Council shall take the matter thereof into their consideration; but the Council shall not so take it into consideration unless twelve Members of the Council at the least shall be present. If this number is not present, the consideration of the request shall be adjourned to the next monthly Meeting of the Council, and so on till a monthly Meeting shall take place at which twelve Members are present. If the Council so constituted shall unanimously agree to the dismissal of such Member, he shall be no longer a Member of the Society; but if they do not unanimously agree to his dismissal, their decision shall be considered to have been made in his favour: Provided always, that his dismissal shall not relieve him from the payment of any debt previously due by him to the Society; and that if a Life-Governor or Life-Member, he shall not have any claim to any portion of the commutation he has paid.

General Meetings in 1850.

The GENERAL MAY MEETING, in London, on Wednesday, May 22, 1850.

The ANNUAL COUNTRY MEETING, at Exeter; principal day of the show, Thursday, July 18, 1850.

The GENERAL DECEMBER MEETING, in London, on the Saturday of the Smithfield Club show-week.

Annual Subscriptions.

SUBSCRIPTIONS may be paid to the Secretary, in the most direct and satisfactory manner, either at the Office of the Society, No. 12, Hanover-Square, London, between the hours of ten and four, or by means of Post-Office orders, to be obtained on application at any of the principal Post-Offices throughout the kingdom, and made payable to him at the General Post-Office, London; but any cheque on a Bank, or other house of business in London, will be equally available, if made payable on demand. The subscriptions are due in advance for each year on the 1st of January, and are in arrear if unpaid by the 1st of June ensuing. No Member is entitled to the Journal, or to any other privilege of the Society, whose subscription is in arrear.

Prize Lists.

The following Prize Lists of the Society, for the year 1850, may be had on application to the Secretary, No. 12, Hanover Square, London.

1. Prize List for Essays and Reports.
2. Prize List for Agricultural Implements, &c. at the Exeter Meeting.
3. Prize List for Live Stock at the Exeter Meeting.

The competition for Essays and Reports closes on March 1, 1850. All entries for Implements are to be made by the FIRST of MAY, and all entries for Live Stock by the FIRST of JUNE. The Prizes of the Society are open to general competition.

NOTICE.

In consequence of the appearance of a new List of Members, and of an unusual press of matter, the ordinary Appendix, and several contributions to the Journal, are unavoidably postponed.

Consulting-Chemist.

The Council have fixed the following rates of Charge for Analyses to be made by the Consulting-Chemist for Members of the Society; who, to avoid all unnecessary correspondence, are particularly requested, in applying to him for analyses, to mention the kind of analysis they require, and to quote its number as specified in the subjoined schedule. The charge for analysis, together with the carriage of specimens, must be paid to him by the members at the time of application.

No. 1. An opinion as to the genuineness of a manure in the market, 7*s.* 6*d.* By this is meant such an opinion as could be formed by a scientific person, by inspection, with a few simple confirmatory experiments.—[It will protect from fraud, but is not calculated to assist in the choice of the best specimens, where all are genuine: it will inform the applicant whether a specimen of guano or oil-cake, for instance, be adulterated or not; but will not touch the question of its relative value as a pure specimen. Such an opinion will only apply to ordinary market articles, as guano, oil-cake, superphosphate of lime, sulphate of ammonia, gypsum, common salt, &c.] No. 2. Guano. A determination of nitrogen (ammonia) and of the earthy phosphates, &c., 1*l.* No. 3. Limestone. The proportion of lime, 7*s.* 6*d.*; the proportion of magnesia, 10*s.*; the proportion of lime and magnesia, 15*s.* This analysis is sufficient for many purposes; but in most limestones the phosphate and sulphate of lime, and magnesia, are present, though in small proportions; and inasmuch as it is impossible to say how much of the effect may be due to other minute ingredients, it is recommended that their quantity should always be determined. No. 4. Limestone, or marls, including carbonate, phosphate, and sulphate of lime, and magnesia, with sand and clay, 1*l.* No. 5. Partial analysis of a soil, including sand, clay, organic matter, and carbonate of lime, 1*l.* No. 6. Complete analysis of a soil, 3*l.* No. 7. Letter asking advice, one topic, 7*s.* 6*d.* On more than one topic, 10*s.* No. 8. Oil-cake, or dung, or any animal products, nitrogen, and phosphoric acid, 1*l.* Oil-cake, including nitrogen, oil, and phosphoric acid, 1*l.* 10*s.* No. 9. A determination of the quantity of carbonate and sulphate of lime in any specimen of water, 1*l.*

The address of Professor Way, the Consulting-Chemist to the Society, is No. 23, Holles Street, Cavendish Square, London.

⁂ Assistants.—As competent assistants will from time to time be required to carry on the increased operations in Professor Way's laboratory, he has made arrangements to receive a few pupils who may wish to qualify themselves in the practice of Agricultural Analyses.

Royal Agricultural Society of England.

LIST OF GOVERNORS AND MEMBERS.

AUTUMN.—1849.

☞ *The Council particularly request the favour of communications being made to the Secretary of any errors observed in this List.*

Royal Agricultural Society of England.

1849—1850.

PRESIDENT.

THE MARQUIS OF DOWNSHIRE.

TRUSTEES.

Acland, Sir Thomas Dyke, Bart., M.
Braybrooke, Lord
Clive, Hon. Robert Henry, M.P.
Graham, Rt. Hon. Sir Jas., Bart., M.P.
Lawley, Sir Francis, Bart.
Neeld, Joseph, M.P.
Portman, Lord
Pusey, Philip, M.P.
Richmond, Duke of
Rutland, Duke of
Spencer, Earl
Sutherland, Duke of

VICE-PRESIDENTS.

Barker, Thomas Raymond
Chichester, Earl of
Downshire, Marquis of
Ducie, Earl of
Egmont, Earl of
Exeter, Marquis
Fitzwilliam, Earl
Gooch, Sir Thomas Sherlock, Bart.
Hardwicke, Earl of
Hill, Viscount
Wellington, Duke of
Yarborough, Earl of

MEMBERS OF COUNCIL.

Austen, Colonel
Barnett, Charles
Bennett, Samuel
Blanshard, Henry
Bramston, Thomas William, M.P.
Brandreth, Humphrey
Burke, J. French
Camoys, Lord
Challoner, Colonel
Childers, John Walbanke, M.P.
Denison, John Evelyn, M.P.
Druce, Samuel
Foley, John H. H., M.P.
Garrett, Richard
Gibbs, B. T. Brandreth
Grantham, Stephen
Hamond, Anthony
Hatherton, Lord
Hillyard, C.
Hobbs, William Fisher
Hudson, George, M.P.
Hudson, John
Johnstone, Sir John V. B., Bart., M.P.
Jonas, Samuel
Kinder, John
Lawes, John Bennet
Leicester, Earl of
Lemon, Sir Charles, Bart., M.P.
Miles, William, M.P.
Milward, Richard
Pelham, Hon. Captain Dudley, R.N.
Price, Sir Robert, Bart., M.P.
Ridley, Sir Matthew White, Bart.
Sewell, Professor
Shaw, William
Shaw, William, junior
Shelley, John Villiers
Simpson, William
Slaney, Robert Aglionby, M.P.
Smith, Robert
Southampton, Lord
Stansfield, W. R. Crompton, M.P.
Stokes, Charles
Stradbroke, Earl of
Thompson, Henry Stephen
Turner, Charles Hampden
Turner, George
Webb, Jonas
Wilson, Henry
Wilson, Hon. H. W.

SECRETARY.

JAMES HUDSON, 12, Hanover Square, London.

Consulting-Chemist.—John Thomas Way, 23, Holles Street, Cavendish Square

Consulting-Engineer.—James Easton, or C. E. Amos, The Grove, Southwark

Seedsmen.—Thomas Gibbs and Co., Corner of Half-moon Street, Piccadilly

Publisher.—John Murray, 50, Albemarle Street

Bankers.—H., A. M., C., A. R., G., and H. Drummond, Charing-Cross

HONORARY MEMBERS.

Austria, His Imperial Highness The Archduke John of
Buckland, The Very Rev. William, D.D., Dean of Westminster
Carr, Captain J. Stanley
Daubeny, Charles, M.D., Professor of Rural Economy, University of Oxford
De la Beche, Sir Henry Thomas, Director of the Ordnance Geological Survey
Everett, the Hon. Edward, President of Cambridge University, U. S.
Graham, Thomas, Professor of Chemistry, University College, London
Henslow, The Rev. J. S., Professor of Botany, University of Cambridge
Hofmann, Dr., Professor of Chemistry, Royal College of Chemistry, London
Johnston, James F. W., Reader in Chemistry, University of Durham
Liebig, Baron, University of Giessen
Murchison, Sir Roderick I., K.S.P., Belgrave Square, London
Parkes, Josiah, C.E., 11, Great College Street, Westminster
Playfair, Dr. Lyon, Chemist to the Ordnance
Simonds, James Beart, Lecturer on Cattle Pathology, R. Veterinary College, London
Solly, Edward, Professor of Chemistry, Horticultural Society, and Addiscombe College
Sprengel, Dr. Charles, Secretary to the Pomeranian Agricultural Society
Stevenson, The Hon. Andrew, Washington
Van de Weyer, M. Sylvian, Belgian Minister
Way, John Thomas, Consulting-Chemist to the Society.

LIST OF GOVERNORS.

† Life Governor's mark.

†Acland, Sir T. Dyke, M.P....Killerton Park, Collumpton, Devonshire
†Albert, H. R. H. the Prince...Windsor Castle
†Alcock, Thos., M.P....Kingswood Warren, Epsom, Surrey
†Aldam, William, Jr., M.P....Frickley Hall, Doncaster
Alford, Viscount...Belton House, Grantham
Amherst, Earl...Knole, Seven Oaks, Kent
†Angerstein, John...Woodlands, Blackheath, Kent
Antrobus, Sir Edmund, Bart....Amesbury Abbey, Salisbury, Wiltshire
Arkwright, C....Burton-upon Trent, Staffordshire
Arkwright, John...Hampton Court, Leominster, Herefordshire
Arkwright, R....Sutton Hall, Chesterfield, Derbysh.
†Ashburton, Lord...Bath House, Piccadilly
Austen, Col. Thomas ... Kippington, Seven Oaks, Kent
†Aylesford, Earl of ... Pakington Hall, Coventry, Warwickshire

†Bailward, J....Horsington, Wincanton, Somerset
†Baker, R. W....Cottesmore, Stamford, Lincolnsh.
†Barclay, Charles...Bury Hill, Dorking, Surrey
†Barclay, David ... Eastwick Park, Leatherhead, Surrey
†Barker, John Raymond ... Fairford Park, Fairford, Gloucestershire
Barker, Thomas Raymond...Hambleden, Henley-on-Thames, Oxon
Barrow, Wm. Hodgson...Southwell, Notts
†Beach, Wm....Oakley Hall, Basingstoke, Hants
Beauchamp, Earl...Madresfield, near Worcester
†Beaufort, Duke of...Badminton, Chippenham, Wiltshire
Beaumont, Lord...Carleton Hall, Selby, Yorks.
Bedford, Duke of...Woburn Abbey, Bedfordshire
Benett, John, M.P....Pyt House, Hindon, Wilts
Benyon, Richard de Beauvoir...Englefield House, Reading, Berkshire
Blake, William..Danesbury, Welwyn, Herts
†Blanshard, Henry...Kirby-in-le-Soken, Colchester, Essex
Blount, William...Orchhill, Gerrard's Cross, Bucks
Bonsor, Jos....Polesden, Great Bookham, Surrey
Bosanquet, G. J. ... Broxbournebury, Hoddesdon, Herts
Boucher, J. G....Shidfield, near Wickham, Hants
†Bowes, John ...Streatlam Castle, Staindrop, Durham
Bramston, T. W., M.P...Skreens, Chelmsford, Essex
Brandreth, Humphrey...Houghton House, Dunstable, Bedfordshire
Braybrooke, Lord...Audley End, Saffron Walden, Essex
Bridport, Lord...Cricket Lodge, Chard, Somerset
Bridges, Sir Brook Wm., Bart. ... Godnestone Park, Wingham, Kent
Briscoe, John Ivatt...Fox Hills, Chertsey, Surrey
Brown, James...Rossington, Bawtry
Buccleuch, Duke of...Whitehall
†Buller, Edward, M.P....Dilhorne Castle, Cheadle, Staffordshire
Buller, Capt. T. Wentworth, R.N....15, Sussex Gardens, Hyde Park
†Bunbury, Sir Henry E., Bart....Barton Hall, Bury St. Edmunds, Suffolk
Burlington, Earl of...Holker Hall, Milnthorpe, Westmoreland
Buxton, Sir Robert Jacob...Shadwell Pk. Thetford

Cabbell, Benjamin Bond, M.P....2, Brick Court, Temple
Calthorpe, Lord...33, Grosvenor Square
†Cambridge, H. R. H. the Duke of...Kew Palace, Surrey
Camoys, Lord...Stonor Park, Henley-on-Thames, Oxon
Campbell, Alex. Francis...Great Plumstead, near Norwich, Norfolk
Campden, Viscount...Exton Park, Stamford, Lincolnshire
Cator, Rev. Thos....Skelbrook Park, Pontefract
†Cavendish, Hon. Chas. Compton, M.P....Latimers, Chesham, Buckinghamshire
Cayley, Sir George, Bart....High Hall, Brompton, Pickering, Yorkshire
Challoner, Col. C. Bisse...Portnall Park, Virginia Water, Chertsey, Surrey
Chichester, Earl of...Stanmer Park, Lewes, Sussex
†Childers, John Walbanke, M.P....100, Eaton Sq.
†Christopher, Robt. Adam, M.P....Bloxholm Hall, Sleaford, Lincolnshire
Clifford, Hon. Chas. Thos....Irnham Hall, Colstersworth, Lincolnshire
Clifton, Thos....Lytham Hall, Preston, Lancashire
†Clive, Hon. Robert Henry, M.P....Oakley Park, Ludlow, Salop
Colvile, Chas. R., M.P....Lullington Hall, Burton-on-Trent, Staffordshire
†Copeland, Alderman, M.P....The Poplars, Leyton, Essex
Cotes, John...Woodcote, Shiffnal, Salop

†Craven, Earl...Coombe Abbey, Coventry
Crawley, Samuel...Stockwood House, Luton, Beds.
Creyke, Ralph...Rawcliffe Hall, Selby, Yorkshire
Crompton, John Bell...Duffield Hall, Derby
Curteis, Major E. B., M.P....Leesam House, Rye

Dacre, Lord...The Hoo, Welwyn, Herts
De la Warr, Earl...Buckhurst Park, East Grinstead, Sussex
Denison, John Evelyn, M.P....Ossington, Newark, Nottinghamshire
Dering, Sir Edw. Cholmeley, Bart....Surrenden-Dering, Charing, Kent
Devonshire, Duke of...Chatsworth, Derbyshire
Dickinson, Francis Henry, M.P....King's Weston, Somerton, Somersetshire
Douglas, Sir Charles, M.P....27, Wilton Crescent
Downshire, Marquis of...East Hampstead Park, Bracknell, Berkshire
Drummond, Chas....Newsells, Royston, Herts
Drummond, Henry, M.P....Albury Park, Guildford
†Ducie, Earl of...Tortworth, Wootton-under-Edge
Duffield, Thos., M.P....Marcham Park, Abingdon, Berkshire
†Dysart, Earl of...Buckminster Hall, Colstersworth, Lincolnshire

†Egerton, Wilbraham...Tatton Park, Knutsford, Cheshire
Egmont, Earl of...Cowdry Lodge, Petworth
Essex, Earl of...Cassiobury Park, Watford, Hertfordshire
Estcourt, T.G. Bucknall...Estcourt, Tetbury, Glouc.
†Etwall, Ralph...The Mount, Nursling, Southampton
Euston, Earl of, M.P....47, Clarges Street
Evans, William, M.P....Allestree Hall, Derby
†Exeter, Marquis of...Burghley House, Stamford, Lincolnshire
Eyre, Charles...Welford, Newbury, Berkshire
Farquharson, J. J....Langton, Blandford, Dorset
†Fellowes, E., M.P....Ramsey Abbey, Huntingdon
Feversham, Lord...Helmsley, York
Feilding, Viscount...Downing Holywell, Flintshire
†Fitzwilliam, Earl...Milton, Peterborough, Northamptonshire
Foley, J. H. H., M.P. ...Prestwood, Stourbridge, Worcestershire
†Fortescue, Earl of...Castle Hill, Southmolton, Devon
Freshfield, J. W....Moor Place, Dorking, Surrey
†Fuller, Francis...29, Abingdon St., Westminster

Gibbs, B. T. B....Brompton Lodge, Old Brompton
Gillies, Robert Maule...17, Mark Lane
Goldsmid, Baron...St. John's Lodge, Regent's Park
Gooch, Sir Thomas S., Bart....Benacre Hall, Wrentham, Suffolk
Gore, Wm. Ormesby, M.P....Porkington Hall, Oswestry, Salop
Grafton, Duke of...47, Clarges Street
†Graham, Right Hon. Sir J., Bart., M.P...Netherby-by-Carlisle, Cumberland
Grey, Earl...Howick House, Alnwick
Guest, Sir J. J., Bart., M.P....Dowlais House, Merthyr Tydvil, Glamorganshire
Guise, Sir John W., Bart....Rendcomb Park, Cirencester, Gloucestershire

Hale, Robert Blagden, M.P....Alderley Park, near Wootton, Gloucestershire
Hale, Wm....Kingswalden Park, Welwyn, Herts
Hall, Sir Benjamin, Bart., M.D., M.P....Llanover Court, Newport, Monmouthshire
Hamond, Anth....Westacre Hall, Rougham, Norf.
Handley, W. F....Newark-upon-Trent, Notts
†Harcourt, George Simon....Ankerwycke House, Staines
Hardwicke, Earl of...Wimpole, Arrington, Cambs.
Hartley, W. H. H....Lye Grove, Cross Hands, Sodbury, Gloucestershire
†Hastings, Lord.....Melton Park, East Dereham, Norfolk
Hatherton, Lord...Teddesley Hall, Penkridge, Staffordshire
Hayter, Right Hon. W. Goodenough, M.P....Stowberry Park, Wells, Somersetshire
Heathcoat, John, M.P....Bolham, Tiverton, Devon.
Heathcote, Gilbert J., M.P....Stocken Hall, Stamford, Lincolnshire
†Heneage, G. F....Hainton Hall, Wragby, Linc.
†Henniker, Lord...Brome Hall, near Eye, Suffolk
†Herbert, Right Hon. Sidney, M.P...Wilton House Salisbury, Wiltshire
†Heywood, Thos. P....Claremont, near Manchester
†Hill, Viscount... Hawkston Park, Shrewsbury, Salop
Hippisley, Henry...Lambourne Place, Hungerford
†Hobbs, Wm. Fisher...Boxted Lodge, Colchester
Hodges, T. L., M.P....Hempsted Park, Cranbrook, Kent
†Hoghton, Henry...Hafod, Aberystwith
†Holford, R. Steiner...Weston Birt House, Tetbury, Gloucestershire
Holbech, Wm....Farnborough, Banbury, Oxfordsh.
Holland, E....Dumbleton Hall, Evesham, Worcest.
Hope, Hen. T....The Deepdene, Dorking, Surrey
Hoskyns, Chandos Wren..Wroxhall Abbey, Warwick
Hulse, Sir Charles, Bart.....Breamore House, Fordingbridge, Hampshire
†Hulse, Lieut.-Col....Breamore House, Fordingbridge, Hampshire
Hyett, W. H. ... Painswick House, Painswick, Gloucestershire

†Ilchester, Earl of....Melbury House, Sherborne, Dorsetshire
Johnstone, Sir John V. B., Bart., M.P....Hackness Hall, Scarborough, Yorkshire

Keene, Rev. Charles Edmund Ruck....Swincombe House, Nettlebed, Henley, Oxfordshire
Kerrison, Lieut.-Gen. Sir E., Bart., M.P....Oakley Park, Eye, Suffolk
Kenyon, Lord....Gredington Hall, Whitchurch, Salop
†Knight, Frederick Winn, M.P....Simon's Bath, Exmoor, Devonshire

Labouchere, Rt. Hon. H., M.P....Stowey, Somerset
Langston, J. Haughton, M.P.....Sarsden House, Chipping Norton, Oxfordshire
Lansdowne, Marquis of....Bowood Park, Calne, Wiltshire
†Lawley, Sir Francis, Bart....Middleton Hall, Fazeley, Staffordshire
†Le Couteur, Colonel, Viscount of Jersey...Belle Vue, Jersey
†Lefevre, Right Hon. C. Shaw, M.P....Heckfield Place, Hartford Bridge, Hampshire
Leicester, the Earl of...Holkham Hall, Norfolk
Leigh, Lord.....Stoneleigh Abbey, Kenilworth, Warwickshire
Lemon, Sir C., Bart., M.P.....Carclew, Penryn, Cornwall
Lisburne, Earl of...Crosswood, Aberystwith, Cardiganshire, S.W.
Liverpool, Earl of....Pitchford Hall, Shrewsbury, Salop
†Long, W., M.P...Rood Ashton, Trowbridge, Wilts
†Lonsdale, Earl of...Lowther Castle, Penrith
Lovelace, Earl of...East Horsley, Ripley, Surrey

MacDouall, Col. James...2nd Life Guards
†Malcolm, Neill...Kilmatin, Lochgilphead, Argyleshire, N.B.
Maitland, E. F....Henley-on-Thames, Oxon
†Marshall, Wm. M.P....Pattendale Hall, Penrith
†Miles, W., M.P....Leigh Court, Bristol, Somerset
Milward, R....Thurgarton Priory, Southwell
†Morrison, Jas...Fonthill Abbey, Hindon, Wiltshire
Moseley, John...Glemham House, Saxmundham, Suffolk
Mostyn, Lord...Pengwern, St. Asaph, Flints. N.W.
Mostyn, Hon. Ed. M. Lloyd, M.P....Mostyn Hall, Holywell, Flintshire, N.W.
Murray, Chas. R. Scott, M.P....Danesfield, Marlow, Buckinghamshire

Naper, Jas. Lennox W....Lough Crew, Old Castle, Ireland
Neeld, Jos., M.P....Grittleton House, Chippenham, Wiltshire
Newry and Morne, Viscount....Marine Parade, Brighton
Northampton, Marquess of...Castle Ashby, Northamptonshire
†Nott, John...Bydown House, Barnstaple, Devon
Nugent, Hon. M. W. Bellew...

Oldham, F. Oldham...Belle-amour Hall, Rugeley, Staffordshire

Palmer, Robt., M.P....Holme Park, Reading, Berks
Patten, John Wilson, M.P....Bank Hall, Warrington, Lancashire
†Peel, Right Hon. Sir Robert, Bart., M.P...Drayton Manor House, Fazeley, Staffordshire
Pelham, Hon. Captain Dudley, R.N., M.P....St. Lawrence, Isle of Wight
†Pendarves, E. W. W., M.P....Pendarves House, Truro, Cornwall
Pennant, Hon. Col. Ed. Gordon Douglas...Penrhyn Castle, Bangor, N.W.
†Percival, John...Woodlands, Ryde, Isle of Wight, Hants
†Perkins, H...Hanworth Park, Hounslow, Midlsex.
Petre, Hen....Dunkenhalgh, Blackburne, Lancashire
Plowden, W...Plowden Hall, Bishop's Castle, Salop
Pole, E. S. Chandos...Radbourne Hall, near Derby
†Popham, F. L...Littlecott, Hungerford, Berks
†Portman, Lord....Bryanston House, Blandford, Dorsetshire
Powlett, Lord William...Downham Hall, Brandon, Norfolk
Price, Sir R., Bt., M.P...Foxley Hall, near Hereford
Pryse, Pryse...Lodge Park, Aberystwith, S.W.
†Pusey, Philip, M.P....Pusey, Faringdon, Berkshire
Pym, F...The Hasells, Biggleswade, Bedfordshire

Quantock, John...Norton House, Yeovil

†Radnor, Earl of....Coleshill House, Faringdon, Berkshire
Rayleigh, Lord...Terling Place, Witham, Essex
†Richmond, Duke of...Goodwood Park, Chichester, Sussex
Ridley, Sir Matt. White, Bart...Blagdon, Morpeth, Northumberland
Ripon, Earl of...Nocton Hall, Lincoln
Rogerson, Joseph...24, Norfolk Street, Strand
Rosebery, Earl of...Warren Wood, Hatfield, Hertfordshire
†Rutland, Duke of....Belvoir Castle, Grantham, Lincolnshire

Saint Germans, Earl...Port Eliot, Devonport
St. Quintin, Wm....Seampstone Hall, Scarborough, Yorkshire
†Sanford, Edward A...Nynehead Court, Wellington, Somersetshire
Scarborough, Earl of...Sandbeck Castle, Bawtry
†Scholey, W. S....Thurlow Terrace, Larkhall Lane, Clapham
Scott, Jas. Winter...Rotherfield Park, East Tisted, near Alton, Hampshire
†Shadwell, Lucas...Fairlight, Hastings
Shaw, William...7, King's Road, Bedford Row
†Slaney, R. A., M.P...Walford Manor, Shrewsbury, Salop
†Smith, J. A., M.P...Dale Park, Arundel, Sussex
†Sondes, Lord...Elmham Hall, Elmham, Norfolk
Somers, Earl...Eastnor Castle, Tewkesbury, Glost.
Sotheron, Thomas H. S. B. E., M.P...Bowden Park, Chippenham, Wiltshire
†Spencer, Earl...Althorp, Northampton
Stanhope, J. S...Cannon Hall, Barnsley, Yorkshire
†Stanley, Lord...Knowsley Hall, Prescot, Lanc.
Stansfield, Wm. R. C., M.P....Esholt Hall, Leeds, Yorkshire
†Stradbroke, Earl of...Henham Park, Wangford, Suffolk
†Strutt, Edward, M.P...St. Helen's, near Derby
†Sutherland, Duke of...Trentham Park, Newcastle-under-Lyme, Staffordshire

†Sutton, Sir R., Bart...
Sutton, Hon. John Manners, M.P. ... Kelham, Newark, Notts

†Tanqueray, John...Hendon, Middlesex
†Thorold, Sir John Charles, Bart.....Syston Park, Grantham, Lincolnshire
†Torrington, Lord Visct....Yokes Court, Mereworth, Kent
†Townley, R. Greaves, M.P...Fulborne House, near Cambridge
Tremayne, J. H...Heligan, St. Austell, Cornwall
Tunno, E. Rose...Warnford Park, Bishop's Waltham
†Turner, Charles H...Rook's Nest, Godstone, Surrey
Turner, Thomas...Croydon

Villebois, Fred...Benham Place, Newbury, Berks

†Wakeman, Sir O. P., Bt...Perdiswell Park, Worcester
Walsh, Sir John, Bart., M.P...Warfield Park, Bracknell, Berkshire
Walsingham, Lord...Merton Hall, Thetford, Norf.
Waterton, Capt. Geo...Grove House, Hunslet, Leeds
Watson, Hon. R...Rockingham Castle, Northampton
†Wellington, Duke of...Strathfieldsaye, Hampshire
†Wenlock, Lord...Escrick Hall, Selby, Yorkshire
West, F. R..Arnwood House, Lymington; Ruthin Castle, Denbighshire
†Whitbread, W. H...South-hill House, near Bedford
Wilbraham, G. .... Delamere House, Northwich, Cheshire
†Williams, Sir Erasmus, Bart...Marlborough, Wilts
Wilmot, E. Woollett...Hulme, Walfield, Congleton
†Wilson, Henry .... Stowlangtoft Hall, Ixworth, Suffolk
Wilshere, William, M.P...The Frythe, Welwyn
Wingate, W. B....Hareby House, Spilsby, Lincolnshire
Wood, Edward Robert...Stout Hall, Swansea
Wood, Col. Thos., M.P...Littleton House, Chertsey, Surrey
Wroughton, B...Woolley Park, Wantage, Berkshire
Wyndham, Col. George...Petworth House, Sussex
Wynn, Sir W. W., Bart...Wynnstay, Rhuabon, Denbighshire

†Yarborough, Earl of.....Manby Hall, Glanford Bridge, Lincolnshire

Zetland, Earl of...Aske Hall, Richmond, Yorkshire

LIST OF MEMBERS.

† Life Member's mark.

†Abbey, G....Silsworth Lodge, Daventry, Northampton
Abbey, John...The Grange, Wellingborough
Abbey, Thos...Dunnington, York
Abbot, C. H....Bower, Long Ashton, Bristol
Abbott, Charles T....36, Gower Street
†Abbott, Step., jun....Castleacre, Swaffham, Norf.
Abel, John...Rising SunInn, Chapel Field, Norwich
Abel, Philip...Northampton
Abinger, Lord...Abinger Hall, Dorking, Surrey
Ablett, J....Llanbedr Hall, Ruthin, N.W.
Abraham, Wm....Barnetby, Brigg, Lincolnshire
†Ackers, J., M.P....Prinknash Park, Painswick
Ackland, R. I....Boulston, Haverfordwest
Acland, Thos. Dyke, M.P....Killerton, Exeter
†Adair, Alexander...Heatherton Park, Wellington, Somersetshire
Adair, Sir R. S., Bart....20 (a), St. James's Square
Adam, Alexander...Boulogne
†Adams, Edward...Bassford Hall, Newcastle, Staff.
Adams, Francis H....Alton Court, Ross, Herefords.
Adams, G. T....Hawkhurst, Kent
Adams, Henry...High Street, Windsor, Berkshire
Adams, Rev. Thos. B....Aldridge Lodge, Walsall, Staffordshire
Adcock, E....Farmdish, Wellingborough, Northam.
Adcock.W....Farmdish, Wellingborough, Northam.
Addams, Charles ...Moor House, Kilton Holford, Bridgewater, Somersetshire
†Adderley, C. B...Hams Hall, Coleshill, Warwicks.
Ade, Charles...Westdean, Lewes
Agar, Hon. G. C.... Boyton House, Heytesbury, Wilts
Aglionby, H. A., M.P....Nunnery, Cumberland
Ainslie, William...Wood Hill, Ripley, Surrey
Aitchison, Capt. R., R.N....Mapperton, Beaminster, Dorset
Aitchison, Wm ...Hazelridge, Belford, Northum.
Aitken, Andrew...Deeping Fen, Spalding, Linc.
Akroyd, Edward...Denton Park, Otley, Yorkshire
†Albright, Arthur...Edgbaston, Birmingham
Albright, Nicholas...Charlbury, near Enstone, Oxon
Alderman, Robert, jun....Farmdish, Wellingboro.
Aldous, Robert...Burlingham, Norwich
Aldridge, James...Throop Farm, near Christchurch, Hants
†Aldworth, W., jun... Frilford, Abingdon, Berks
Alexander, C....Sudbury, Suffolk
Alexander, James...Doncaster, Yorkshire
Alexander, Rev. John...Norwich
Alexander, Wm. Maxwell...Ballochmyle, Mauchline, Ayrshire, N.B.
†Alington, G. M....Swinhope House, Louth, Linc.
Alington, H. W....Welton-on-the-Hill, Louth, Linc.
Allday, John...Griston, Watton, Norfolk
†Allen, B. Haigh...Longcroft's Hall, Lichfield
Allen, Chas. W....The Moor, Kington, Herefordsh.
Allen, Henry...Oakfield, Hay, Herefordshire
Allen, J....Holt Farm, Pilton, near Shepton Mallett
Allen, John...Wellington, Newcastle-upon-Tyne
Allen, Seymour...Cresselly, near Pembroke
Allen, Thomas...Thurmaston, Leicester
Allen, T., jun....Upton Cottage, Macclesfield, Ches.
Allen, William...The Lodge, Malton, Yorkshire
†Allfrey, Robert...Wakefield Park, Reading, Berks
Allhusen, Christian...Elswick House, Newcastle-upon-Tyne
Allies, George...Hill House, Worcester
Allin, Richard...Little Moore, Oxford
Allin, Wm....Great Hendred, Wantage, Berkshire
Allington, Rev. J....Little Barford, St. Neot's, Huntingdonshire
Allison, Joseph...Bilby, Retford, Nottinghamshire
Alliston, John...38, Russell Square
Allix, Chas....Willoughby Hall, Grantham, Linc.
Allnatt, John Joseph...Wallingford
Allsop, Henry...Burton-on-Trent, Staffordshire
Allsop, John...Wellow Farm, Romsey, Hampshire
Allsop, Thomas...Ridge Green, Ryegate, Surrey
Almack, Barugh...18, Sackville Street
Almack, John, jun....Leckonfield Park, Beverley, Yorkshire
†Ambler, Henry..Watkinson Hall, Halifax, Yorksh.
Ambrose, John...Copford, Colchester, Essex
Ames, George Henry...Cote House, near Bristol
Ames, John...33, Green Street, Grosvenor Square
Ames, Lionel...The Hyde, St. Albans, Herts
Anderdon, J. L....3, New Bank Buildings
Anderson, Jos....Whitley, Tynemouth, Northumberland
Anderson, Robert...Cirencester, Gloucestershire
†Anderson, Robert...Grey Street, Newcastle-upon-Tyne
Anderson, Robert...Weston, South Shields, Durham
Anderson, Thomas...Little Harle Tower, Newcastle-on-Tyne, Northumberland
Anderson, William...Bont House, South Shields
Anderson, William, jun....Newcastle-upon-Tyne
Andrew, George...Carne, St. Austell, Cornwall
Andrewes, Charles James..Kate's Grove Iron-Works, Reading, Berkshire
Andrews, Edwin...Shroton, Blandford, Dorsetshire
Andrus, Francis... Scadbury, Southfleet, nr. Gravesend

Angeworth, William...The Hay, Bridgnorth
†Annandale, Peter....Shotley Grove, Newcastle-upon-Tyne
Annesley, Rev. Charles A. F....Eydon Hall, near Banbury, Oxon
Ansley, G....Houghton Hill, St. Ives, Hunts
Anslow, William ..Eyton, Wellington, Salop
Anstice, J....Madeley Wood House, Broseley, Salop
†Anstruther, J. H. L...Hintlesham Hall, Ipswich
†Anstruther, Sir R. A., Bart....Balcaskie, Leven, Fifeshire
Antrobus, Joseph...Barnton, Northwich, Cheshire
Aplin, Henry...Combe St. Nicholas, near Chard, Somerset
Appleby, Wm....Eastfield, Alnwick, Northumb.
†Applewhaite, Edw....Pickenham Hall, Swaffham, Norfolk
Arbuthnot, Right Hon. Charles...Kettering, Northamptonshire
†Arbuthnot, John A....Coworth, Chertsey, Surrey
Arch, J....Clifton, near Shefford, Bedfordshire
Archbold, James...Newcastle-upon-Tyne
Archbold, John...Riffington, Berwick-on-Tweed
†Archbold, Robert, M.P....David's Town, Castle Dermot, Ireland
Archer—Burton Lancelot...Woodlands, Emsworth, Hampshire
Archer, Edward...Trelaske, Launceston, Cornwall
Archer, Thomas...Ely, Cambridgeshire
Archer, William...Tullibardine Cottage, Auchterarder, Perthshire
†Arden, Hon. R. P....Pepper Hall, Catterick
Arkcole, Wm....Langney, Westham, Eastbourne, Sussex
†Arkell, Thomas...Pen Hill Farm, Cold Harbour, Swindon, Wiltshire
Arkwright, E....Rock House, Matlock, Derbysh.
Arkwright, Rev. J....Mark Hall, Harlow, Essex
Arkwright, Peter...Willersby, Matlock, Derbysh.
Armitage, Arthur...Moraston, nr. Ross, Herefordshire
Armitage, George...Yattendon, Newbury
Armstrong, Charles...Axwell Park, Gateshead
Armstrong, George...Heddon-on-the-Wall, Newcastle-upon-Tyne
Armstrong, Joseph...Higham Place, Newcastle-upon-Tyne
Armytage, Col....Broomhill Bank, near Tonbridge Wells
Arnett, Henry...Ifield, Crawley, Sussex
Arrowsmith, W. L....Island of Malta
Arundell, Hon. Robert A...Houghton Lodge, Stockbridge, Hants
Ashdown, George....Braxted Hall Farm, Witham, Essex
Ashdown, Samuel H....The Hern, Shiffnal, Salop
Ashhurst, John Henry...Waterstock, Oxford
Ashley, Charles Gordon...Butcombe Court, near Wrington, Somersetshire
Ashlin, John...Frisby, Spilsby, Lincolnshire
Ashmore, Joseph...Norton, near Evesham, Worcsh.
†Ashton, Hen....Woolton, near Liverpool, Lancash.
Ashton, Richard...Limefield, Bury, Lancashire
Ashwin, Thomas...Stratford-on-Avon, Warwicksh.
†Askew, Sir Henry...Pallinsburn House, Coldstream, N.B.
Assheton, Wm....Downham Hall, Clitheroe, Lanc.
†Astbury, William...4, Munster Terrace, Fulham
†Astley, Francis L'Estrange...Melton Constable, Thetford
Aston, Rt. Hon. Sir Arthur...Aston Hall, Preston Brook, Cheshire
†Aston, Samuel...Lynch Court, near Leominster
Atcherley, Thos. C....The Hurst, Westbury, Salop
Atherton, George T....Mount Alyn, Wrexham
†Athorpe, J. C....Dinnington Hall, Sheffield
Atkins, E. M....Kingston-Lisle, Wantage, Berks
Atkins, Thomas.. Kimberley, Wymondham, Norf.
Atkinson, Charles...Broughton, Cartmell
†Atkinson, George..Morland Hall, near Penrith
†Atkinson, James...Winderwath, Penrith, Cumberland
†Atkinson, James Henry Hollis...Angerton, Morpeth, Northumberland
Atkinson, John...Newbiggin, near Hexham
Atkinson, John...Charlton, near Salisbury, Wilts
Atkinson, Joseph...Embleton, near Alnwick
Atkinson, J. R. W....Elmwood House, Leeds
Atkinson, Matthew...Peepy, Hexham, Northumberland
Atkinson, Ralph...South Gosforth, Newcastle-on-Tyne
Atkinson, Thos...Kidside, Milnthorpe, Westmoreld.
Atkinson, Tobias...Kendal, Westmoreland
†Atkinson, Wm. James...Marlow, Buckinghamshire
Attenborough, James...Brampton Ash, Market Harborough, Leicestershire
Attenborough, Robert...Braybrooke, Market Harborough, Leicestershire
Atterbury, Henry Thomas..Woburn, Bedfordshire
Attwood, William...Manor Farm, Longstock, Stockbridge, Hampshire
Atty, James...Rugby
†Austen, Col. Henry...Bellevue, Seven Oaks, Kent
Austen, Robt...Merrow House, near Guildford, Surr.
Austin, William Hazledine...Manor House, Woore, near Market Drayton
Avery, Thomas Charles...Gloucester
Aylmer, John Harrison...Walworth Castle, Darlington, Durham
†Aynsley, J. Murray...Torkington, near Bristol
Ayre, Thomas...Trafford Park, Manchester
Ayres, Robert...Girtford, Biggleswade, Bedfordshire

†Babington, Charles Cardale, M.A....St. John's College, Cambridge
Back, Hatfield James.. Hethersett Hall, Norwich
†Back, John Alfred...Hethersett Hall, near Norwich
†Backhouse, Edmund...Polam Hill, Darlington
Bacon, James...Pluckley, near Ashford, Kent
Bacon, Rich. Noverre...Mercury Office, Norwich
Bacon, William...Chilton House, Darlington
Badcock, Benjamin...Broad Street, Oxford
Baddeley, Thomas...Wellington, Salop
Baddeley, William...Brutton, Wellington, Salop
Baden, Andrew..Long Street, Enford, Pewsey, Wilts

Bagge, Richard...Gaywood, Lynn, Norfolk
†Bagot, Hon. Wm...Blithefield, Rugeley, Staffs.
Bagshawe, Wm. John...The Oaks, near Sheffield
†Bailey, Charles...5, Stratford Place
Bailey, Edward...Martyr'sWorthy, near Winchester, Hants
Bailey, George...Lea Hall, Albrighton, near Wolverhampton
†Bailey, James...Nynehead, near Wellington, Somersetshire
Bailey, James Wm....Shenley House, Stony Stratford, Bucks
†Bailey, Joseph, M.P...Glanuske Park,Crickhowell, Brecknockshire
Bailey, Joseph, jun., M.P...Easton Court,Tenbury, Worcestershire
†Bailey, William...Hazling, near Belford, Northumberland
Bailey, Wm....Hursley, near Winchester, Hampsh.
Baillie, Wm. Hunter...4, Upper Harley Street
Bainbridge, C. H....Lumley Park, Fence Houses, Durham
Baines, John...Goosnargh, Preston, Lancashire
Baines, John Fuller...Stisted, near Braintree, Essex
Baird, Sir David, Bt....Newbyth, East Lothian
Baker, Benj. Heath...Acle, Norfolk
†Baker, Sir Edward Baker, Bart....Ranston House, Blandford, Dorsetshire
Baker, George Williams...Park Farm, Woburn
Baker, Joseph Brogden...Throxenby Hall, near Scarborough
Baker, Rev. R. H....Linchmere, Liphook, Hampsh.
Baker, Robert...Writtle, Essex
Baker, R....Chisshill Hall, near Royston, Hertfordshire
Baker, Robert...West Hay, near Bristol
Baker, T. Barwick L....Hardwick Court, Gloucester
Baker, T., jun...Chilton, near Ferry Hill, Durham
Baker, T. Baker...Hastings, Sussex
Baker, William Robert...Bayfordbury, Hertford
Baldwin, T...Barnt Green, near Bromsgrove, Worc.
Baldwin, W. W. T....Stede Hill, Maidstone, Kent
Bale, S....Flint Hall, East Harling, Norfolk
Balguy, John...Duffield, near Derby
Ballard, James...Llwynhelig, Cowbridge, Glamorganshire
Balls, George...Brixton Hill, Surrey
Balman, W...Radley Barton, South Molton, Devon
Balmer, Thomas...Fochabers, N. B.
†Bankes, John Scott...Corfe Castle, Dorsetshire
†Bannerman, Alex.....South Cottage, Chorley, Lancashire
Bannerman, Henry...Hunton Court, Maidstone
Bannister, J. S....Weston, near Pembridge, Herefordshire
Barber, John...Derby
Barber, Thomas...Hobland Hall, Great Yarmouth
Barber, Rev. William...Duffield, Derby
Barberie, John...House Dean-Farm, Falmer, Lewes
Barclay, Donald...Mayfield, Uckfield, Sussex
Barclay, J. Pringle...Wickham Market, Suffolk
Baring, Hon. Francis Thornhill....Buckingham House, Brandon, Norfolk
Baring, Hon. and Rev. Fred....Melchit Park, Salisbury
Baring, John...Oakwood, Chichester, Sussex
Barker, Rev. Benjamin...Shipdham Rectory, Thetford, Norfolk
†Barker, G. Raymond...Fairford Park, Fairford, Gloucestershire
†Barker, H. B. Raymond..4, Garden Court, Temple
Barker, Horace...Suffolk Fire Office, Bury St. Edmunds
Barker, James...North Shields
Barker, James...The Hall, Bakewell, Derbyshire
Barker, J. H...East Lodge, Bakewell, Derbyshire
Barker, Robert...Glynn, Barmouth, Merionethshire
Barker, William...Claremont, Poulton, Bebington, Cheshire
Barkus, William, senior...Coxhoe, Durham
Barlow, Frederick Burgh...Woodbridge, Suffolk
Barlow, Rev. Peter...Cockfield Rectory, Staindrop, Durham
Barnard, Charles... Norwich
Barnard, E...Coldham Hall, Wisbeach, Cambs.
Barnard, E. G., M.P...Gosfield Hall, Halstead, Essex
Barnard, Ferdinando...Manor Farm,Wantage,Berks
Barnard, Fulke Toovey. .Bristol
Barnard, John...Olives, Dunmow, Essex
Barnardiston, N. C...The Ryes, Sudbury, Suffolk
†Barneby, William...Clater Park, near Bromyard
Barnes, John Stagg..Middleton in Teasdale, Durham
Barnes, Thomas...Whitburn, near Sunderland
Barnett, C...Stratton Park, Biggleswade, Beds.
Barnett, Henry...Glympton Park, Woodstock
Barnett, Joseph ... Remenham Hill, Henley-on-Thames, Oxon
Barratt, John...Winterton, Brigg, Lincolnshire
Barratt, William...St. John's, Wakefield
Barrett, G. A....Kate's Grove Iron-Works, Reading, Berkshire
Barrett, James...Royal Hotel, Ross, Herefordshire
Barrington, Visc., M.P...Beckett House, Faringdon, Berkshire
Barroby, Christ...Baldersby, near Ripon, Yorkshire
Barrow, Charles James...Lopham, Norfolk
Barrow, G. H...Ringwood House, Chesterfield
Barry, Thomas...Chilton, near Thame, Oxon
Barter, Rev. V. C...Sarsden, Chipping Norton, Oxf.
Bartholomew, Thomas...Largton, Wragby, Lincolnshire
Bartholomew, W...Goltho, Wragby, Lincolnshire
Barthropp, Nathaniel...Cretingham Rookery, near Woodbridge, Suffolk
Barthropp, N. G...Cretingham, Woodbridge
Bartlett, Wm...Burbage, near Marlborough, Wilts
Bartlett, William...Whatcombe, Blandford, Dorset
Barton, Henry...Rangemoor House, near Lichfield
Barton, Humfrey C...Hastings
Barton, John...East Leigh, Emsworth, Hants
Barton, Nath...Corsley House, Warminster, Wilts
Barton, R. Watson...Springwood, Manchester
Barton, Thomas...Threxton, Watton, Norfolk
Barwell, John...Norwich
Bascombe, Thomas...Dorchester, Dorsetshire
Baskerville, H. .Crowshy Park, near Reading, Berks

Baskerville, Thos. B. M., M.P....Clyro Court, Hay, Herefordshire
Bass, Michael...Burton-on-Trent, Staffordshire
Batard, Thomas M. Bearda...Sydenham, Kent
Bate, Edward...Kelsterton, Flintshire, N.W.
Bate, G...Houghton, Rougham, Norfolk
Bate, Robert...The Square, Bridgewater, Somerset
Bate, Samuel....Knutton, Newcastle-under-Lyme, Staffordshire
Bate, William...Yaxley, Eye, Suffolk
Bateman, Henry...Asthall, Witney, Oxfordshire
Bateman, Henry...Maple Lodge, Rickmansworth, Hertfordshire
Bateman, Thomas...Guilsborough, Northampton
Bateman, Thos. Hudson..Halton Park, near Lancast.
Bates, Rev. C. C...Castleton, Bakewell, Derbyshire
Bates, Edward...Shieldykes, Alnwick
Bates, George...Heddon, Newcastle-on-Tyne
Bates, Thos...Kirkleavington, near Yarm, Yorkshire
Bates, Thos. Ellis...Fittleton, Amesbury, Wilts
Bath, Robert Phippen...Northover, Glastonbury, Somersetshire
Bath, Thomas...Northover, Glastonbury, Somerset
Bathurst, Earl of...Cirencester, Gloucestershire
Bathurst, Hon. Wm. L...38, Half-moon Street
Batley, Benj. James...Lee Road, Blackheath, Kent
†Batson, Thos...Kynastone House, near Ross, Herefordshire
Batt, William...West Drayton, Uxbridge, Middlesex
Batten, Abraham..Ayott St. Peter's, Welwyn, Herts
†Batten, John...Yeovil, Somersetshire
Batterham, John...Terrington, near Lynn, Norfolk
†Battersby, A. G. Harford...Stoke Park, Redland, near Bristol
†Battersby, John Harford....Stoke Park, Redland, near Bristol
Batty, Benjamin R....Fenny Hall, near Huddersfield
Bawden, H. J. Norris...Southmolton, Devon
Bawtree, F....Abberton, Colchester
Bawtree, John...Abberton, near Colchester, Essex
Baxter, Robert...Doncaster, Yorkshire
Baxter, S. S....Atherstone, Warwickshire
Baxter, William Edward...35, High Street, Lewes
Bayes, T. H....Oak Farm, Iltringham, Aylsham
Bayning, Rev. Lord...Honingham Hall, Norfolk
Bayne, William...High Street, Oxford
Bayzand, Joseph..Kingley, near Alcester, Warwksh.
Beach, John...Redmarley, near Gloucester
†Beach, Sir Michael Hicks, Bt....Williamstrip Park, Fairford, Gloucestershire
†Beadel, James...Witham, Essex
Beadon, Rev. Frederick...North Stoneham Rectory, Southampton
Beale, James...Canford, Wimborne, Dorset
†Bearcroft, Edw...Mere Hall, Droitwich, Worcestsh.
Beard, Rev. Jas....Goldington House, near Bedford
Beard, John...Berwick Hall, Whitecolne, Halstead, Essex
Beard, William...Tormarton Cross Hands, Cirencester, Gloucestershire
Beards, Thomas...Stowe, near Buckingham
Beare, Samuel...Town Close, Norwich
†Beart, Robert...Godmanchester, Huntingdonshire
Beaseley, John...Brampton, near Northampton
Beaseley, Thomas Calvert...Harston, Grantham
Beauchamp, George Edw...The Priory, near Reading, Berks
Beauclerk, Lord Chas...80, Piccadilly
Beauford, Henry W...Bletsoe, near Bedford
Beaumont, E. B...Firmingley, Bawtry, Notts
Beaumont, John...Dalton, Huddersfield
†Beaumont, John Aug....Westhill, Wimbledon, Surrey
Beaumont, Joshua...Parkton Grove, Honley, Huddersfield
Beck, Charles Wm....Upton Priory, near Macclesfield, Cheshire
Beck, Edw...Harpley, Lynn, Norfolk
Beck, John...Congham, Castle Rising, Norfolk
Beck, John, jun...Castle Rising, Norfolk
Beck, Peter...Shrewsbury
Beckett, William, M.P...Kirkstall Grange, Leeds, Yorkshire
Beckford, Wm...12, Upper Belgrave Street
Beckwith, Rev. Henry ... Eaton Constantine, Shrewsbury
Beddall, Charles...Dairy Farm, Finchinfield, Braintree, Essex
Beddall, Henry...Finchinfield, Braintree, Essex
Beddall, John ..Brent Hall, Finchinfield, Braintree, Essex
Beddall, Thomas, jun...Justices, Finchinfield, Braintree, Essex
Beddoe, Richard Cartwright...Bristol
Bedford, John...Woodcote, near Shiffnal, Salop
Beevor, Henry...Barnby Moor, East Retford, Notts
Beevor, Sir T. B., Bart...Hargham Hall, Attleborough, Norfolk
Belcher, Robert Shirley...Burton-on-Trent, Staffordshire
†Beldam, Valentine...Royston, Hertfordshire
Belding, George...Newmarket Road, Norwich
Belding, Geo. B., jun....Newmarket Road, Norwich
Bell, Christopher Seymour...Park Cottage, Alnwick
Bell, Henry...West Sherbourne, near Durham
Bell, John...Break's Hall, Appleby, Westmoreland
Bell, Matthew, M.P...Woolsington, near Newcastle-on-Tyne
Bell, Richard Hansell...Deckham Hall, Gateshead
Bell, William...32, Bucklersbury
Bell, William Read...Gillingham, Shaftesbury
Bellairs, Rev. Henry...Bedworth Rectory, Coventry, Warwickshire
Belliss, Thomas...Brittle Street, Birmingham
Belliss, William...Burlington, Shiffnal, Shropshire
Beman, Robt...Moreton-in-the-Marsh, Gloucesters.
Bence, Henry Alex....Oxford and Cambridge Club
Bencraft, Stephen...Barnstaple, Devon
Benington, Wm...Stockton-upon-Tees
Benn, Joseph...Lowther, Penrith, Cumberland
Benn, Thomas...Greenbank, Whitehaven
Bennet, Philip...Rougham Old Hall, Bury St. Edmunds, Suffolk
Bennet, Philip, jun., M.P....Rougham Hall, Bury St. Edmunds, Suffolk
Bennett, Absalom...Mertyn Hall, Holywell, Flint.

†Bennett, Barwell Ewins...Marston House, Market Harborough, Leicestershire
Bennett, Charles...New Inn, Stowe, Buckingham
Bennett, Edward...Tettenhall, Wolverhampton
Bennett, John...Ingstone, Ross, Herefordshire
†Bennett, Joseph...Hitchin, Hertfordshire
Bennett, Joseph B. H...Tutbury, Burton-on-Trent, Staffordshire
Bennett, Samuel...Bickering's Park, Woburn, Beds.
Bennett, Thomas...Penk Farm, Woburn, Beds.
Bennett, Thomas Oatley...Bruton, Somersetshire
Bennett, William...Lewsey, near Luton, Beds.
Bennion, Edw. David...Summer Hill, Oswestry
Benson, Alan..Papcastle, near Cockermouth, Cumb.
†Benson, Rev. Henry B....Utterby House, Louth, Lincolnshire
Benson, John...Secretary of Farmers' Club, York
Benson, John...Tavistock, Devonshire
Bent, John...Liverpool
Bent, Major John...Wexham Lodge, Slough, Bucks.
Bent, William, jun....Walton Grove, Walton-on-Thames
Bentall, Edward Hammond...Heybridge, near Maldon, Essex
Benyon, Rev. E. R....Culford Hall, Bury St. Edmunds, Suffolk
†Bere, Montague B...Exeter
Beridge, Rev. Basil...Algarkirk, Spalding, Linc.
Bernard, Rev. W....Chatworthy, Wiveliscombe, Somersetshire
Berners, Captain Hugh, R.N....Gatcombe House, Newport, Isle of Wight
Berners, John...Holbrook, Suffolk
†Berney, Sir Henry, Bart....Sheepy, Atherstone, Warwickshire
Berney, Rev. Thomas...Hockering, near Norwich
Berridge, Matthew...Ingarsby, Leicestershire
Berry, John...Chagford, Exeter, Devonshire
†Berwick, Lord...Cronkhill, Shrewsbury
Besley, Henry...South Street, Exeter
Best, Rev. F....Flyford Flavell, Alcester, Worcest.
Best, George...Compton, Guildford, Surrey
Best, Jas....Park House, Boxley, Maidstone, Kent
Best, Hon. and Rev. Samuel...Abbots-Ann, Andover, Hampshire
Best, Rev.T....Red Rice House, near Andover, Hants
Bethell, John...Brighton
Bethell, Richard...Worglesdon, Guildford, Surrey
Bethell, William...Rise, Beverley
†Bethune, J. D....Thorncroft, Leatherhead, Surrey
Betts, John...King's Langley, Hertfordshire
Bevan, George Rees...Brecon, S. W.
Beynon, John...Adpar Hill, Newcastle Emlyn, Carmarthenshire
Bick, Michael...Park Hill, Bromsgrove, Worcestsh.
Bicknell, Charles...Beaumaris, Anglesey
Biddle, Waring...Long Ham, Wimborne, Dorset
Biddulph, Robert...Ledbury, Herefordshire
Biddulph, Robert M....Chirk Castle, Chirk, N. W.
Biel, Wm....St. Leonard's Farm, Beaulieu, near Southampton
Bigg, Edward Smith...The Hyde, Slaugham, Sussex
Bigg, Thomas...21, Church Place, Hampstead
Bigge, Chas. Wm....Linden, Morpeth, Northumld.
Bigge, Matthew Robert...Newcastle-upon-Tyne
Biggs, H....Stockton House, Heytesbury, Wilts
Biggs, James...Desborough, Kettering
Bignold, Samuel...Norwich
Bilbie, Thos....Nettleworth Hall, Mansfield, Notts
Bill, John...Trent Vale, Newcastle, Staffordshire
Billington, Leonard...Bull Hotel, Preston, Lancash.
Binks, Christopher...Friars Goose House, Gateshead
Birch, William John...Pudlicot, Enstone, Oxon
Birch, Wynley...Wretham Park, Thetford, Norfolk
Birchall, A. C....Darlington
†Birchall, T....Kibbleton Hall, Preston, Lancashire
Bircham, Robert...Dunton, Fakenham
Bircham, Samuel...Booton Hall, Reepham, Norfolk
Bird, Rev. Christopher...Chollerton, Hexham
†Bird, Rev. James Waller...Breston, East Dereham
†Bird, John...Yaxley, near Stilton, Huntingdonsh.
Bird, J. A....Park Cottage, Brixton, Surrey
Bird, Thomas...Westerfield, Ipswich, Suffolk
†Birkbeck, Henry...Norwich
Birket, Chas....Plungington Hall, Preston, Lancash.
Birks, J....Hemmingfield, near Barnsley, Yorksh.
Birt, Jacob...30, Sussex Gardens, Hyde Park
Biscoe, Thomas P. B....Kingellie House, Inverness
Bishop, John...23, New Bridge Street, Blackfriars
Bishop, John...Norwich
Bishop, Thomas...Brecon, S. W.
Bissill, Edward...Sutterton, Boston, Lincolnshire
Black, John...Marske, near Guisborough, Yorkshire
Blackbourn, D....Temple Brewer, Sleaford, Linc.
Blackburne, John Ireland, M.P....Hale, near Warrington, Lancashire
Blackburne, Captain John Ireland, junr....Light Oaks, Cheadle, Staffordshire
Blackden, J. C....Ford, Berwick-on-Tweed
†Blacker, Murray...Loft Monks House, Beccles, Suffolk
Blacker, William...Armagh, Ireland
Blackett, Sir Edwd., Bart....Matfen, Newcastle-on-Tyne, Northumberland
Blackett, Henry...Sockburn, Darlington, Durham
Blackstone, J....31, Bayham Terrace, Camden Town
Blagrave, Edward...Magdalen College, Oxford
Blagrave, Col. John...Calcot Park, Reading, Berks
†Blair, John...
Blake, Francis John...Norwich
Blake, James...Bathingbourne, Newport, Isle of Wight, Hampshire
Blake, S. W....Venne House, near Wiveliscombe, Somerset
Blake, Thomas...Horstead, Norwich
Blake, William Jex....Swanton Abbots, Scottow, Norfolk
Blake, Wm. John...62, Portland Place
Blakeway, William...Leigh Hall, Worthen, near Shrewsbury
Blakiston, Thomas...Thorpe Old Hall, Norwich
Bland, John...Wine Street, Bristol
Bland, William...Hartlip, Sittingbourne, Kent
Blane, Capt. Robert...2nd Life Guards
Blane, Sir Seymour, Bart....The Pasture, Derby
†Blane, Lieut.-Col....16, Lower Grosvenor Street

†Blanshard, Richard...37, Great Ormond Street
Blayds, C. C.... Seal Lodge, Farnham, Surrey
Blayds, John...Oulton Hall, Leeds
Blencowe, John George..The Hooke, Chailey, Lewes
Blencowe, Robert W....The Hooke, Lewes, Sussex
Blenkensop, John...Slake House, South Shields
Blennerhassett, Rev. William...Iwerne Vicarage, Blandford
Blick, Rev. Charles...Brandesburton, near Beverley
†Bliss, Rev. Philip, DD....Oxford
Bliss, William...Dean House, Kimbolton
Blisset, Rev. H....Letton, Weobley, near Hereford
Blomfield, Lieut.-Col....Necton Hall, Swaffham
Blomfield, John, jun....Warham, Wells, Norfolk
Blood, J. Howell...Witham, Essex
Bloodworth, Thos....Kimbolton, Huntingdonshire
Bloxham, William...28, Duke Street, Grosvenor Square
Blundell, Joseph...Maidenstone Heath, Hound, Southampton
Blundstone, Wm....Lady Wood, Rick Hallam, near Derby
Blunt, Edwd. W....Kempshott Park, Basingstoke, Hampshire
Blyth, D'Urban...Great Massingham, Rougham, Norfolk
Blyth, H. E....Burnham Westgate, Norfolk
Blyth, Robert John...Norwich
Blyth, William...Weasenham, Rougham
Boards, William...Edmonton, Middlesex
Roby, Charles...Alton Hall, Stutton, Ipswich, Suffolk
Boddington, Benj....Burcher Court, near Kington, Herefordshire
Boden, Henry ..The Field, Derby
Bodenham, Francis Lewis...Hereford
Bodley, John...Stockleigh, Crediton, Devonshire
Body, Moses...Northiam, Rye, Sussex
Body, Wm....South Brent, near Cross, Somerset
Boger, Deeble...Plympton, Devonshire
Boileau, John Elliot...Ketteringham Park, Wymondham
Boileau, Sir John Peter, Bart...Ketteringham Park, Wymondham, Norfolk
Bolam, Christopher...Low Trewitt, Rothbury, Northumberland
Bolam, Isaac W....Fawdon, Whittingham, Northumberland
Bolam, Jno...Easington Grange, Belford, Northumb.
Bolam, William...Newcastle-upon-Tyne
Bolden, John...Hyning, Lancaster
Bolden, Samuel Edward...Lancaster
Boldero, H....South Lodge, Horsham
Bolton, George...Shropham, Larlingford
Bolton, Lord...Hackwood Park, Basingstoke, Hants
Bompus, G. G., M.D....Fishponds, Bristol, Som.
Bond, Barnabus...Alburgh, Harleston, Norfolk
Bond, Benjamin...Draycot, Stone, Staffordshire
Bond, Rev. N....Eglestone Holme, near Wareham, Dorsetshire
Bond, Thomas...Bishop's Lydeard, Taunton
Bond, Thos. James ...Perry Elm, Wellington, Somerset
Bonham, Rev. J....Ballintaggart, Ballitore, Ireland
Booker, Josias...Allerton, near Liverpool
Booker, Thos. Wm....Velindra House, near Cardiff, Glamorganshire
Booth, James Godfrey...Hamburgh
Booth, John...Kelston Grange, Louth, Lincolnshire
Booth, John...Killerby, Catterick, Yorkshire
Booth, John...Cotham, Newark, Nottinghamshire
Booth, Richard...Warlaby, Northallerton, Yorksh.
Booth, Wm. B....Carclew, near Penryn, Cornwall
Boothby, J. B....Twyford Abbey, Acton, Middlesex
†Borough, C. B....Chetwynd Park, Newport, Shropshire
Bosanquet, Rev. R. W....Roch, near Alnwick, Northumberland
Bostock, Ellis...41, Hunter Street, Brunswick Sq.
Boswell, Thos. Alexander...Crawley Grange, Newport Pagnell, Bucks.
Bosworth, Charles...Dishley, Loughborough
Bosworth, Thos. Wright...Spratton, Northampton
†Botfield, Beriah...Norton Hall, Daventry, Northamptonshire
†Botham, George...Wexham Court, Slough, Bucks.
Bott, John...Coton Hall, Burton-on-Trent, Staff.
Boucher, Chas....Greenway House, Wiveliscombe
Boucher, Jas....Kinlet Hall, Bewdley, Worcest.
Boucher, Jas. G., jun....Shidfield House, Wickham, Hampshire
Boucherett, A....Willingham House, Market Rasen
Boughton, Sir W. E. R....Downton Hall, Ludlow, Salop
Boultbee, John...Noyadd House, Aberayron, South Wales
†Bourn, James, jun....Mawley Town Farm, Cleobury Mortimer, Shropshire
Bourne, John...Hildenstone, Stone, Staffordshire
Bourne, John...5, South Parade, Leeds
Bourne, Wm. Kemp...Fisherwick, Lichfield
Bouverie, Edward...De la Pré Abbey, Northampton
Bouverie, Hon. P. Pleydell...Brymore, Bridgewater, Somersetshire
Bouverie, Rev. W. Arundell...Denton Rectory, Harleston, Norfolk
Bowden, Henry...Coopers, Chislehurst
Bowen, Geo....Coton Hall, Prees, near Whitchurch, Shropshire
Bowen, Jas....Troedyraur, Newcastle-Emlyn, S. W.
Bower, Thomas Bowyer...Iwerne House, Blandford
Bowers, John...Westdean House, Chichester, Sussex
Bowett, Thomas...Warsop, near Mansfield, Notts
Bowles, J. T....Milton Hill, Abingdon, Berks
Bowly, David...Cirencester, Gloucestershire
Bowly, Edw....Siddington House, near Cirencester, Gloucestershire
Bowly, William C....Cirencester, Gloucestershire
Bowman, Chas....Greatford, Market Deeping, Lincolnshire
Bowman, Fred....Belmont Cottage, Duddington, Stamford, Linc.
Bowser, Richard...Bishop Auckland, Durham
Bowser, Wm....Tunstall, near Hartlepool, Durham
Bowstead, John...Beckbank, Penrith, Cumberland
Box, Philip...Radclive, Buckingham

Boxall, W. B....Stopham, Petworth
Boycott, Thos....Rudge Hall, Wolverhampton, Staff.
Boycott, Wm....Donnington, Shiffnal, Shropshire
Boyd, Thomas...Holt, Norfolk
Boyes, Wm. Edw....Alkerton, Banbury, Oxfordsh.
Boyle, Robert...Ayr, Scotland
Boys, Robert...Eastbourne, Sussex
Bracebridge, C. H....Atherstone Hall, Atherstone
Brackenbury, Wm. T....Shouldham-Thorpe, Downham, Norfolk
Braddock, Henry...Bury St. Edmunds, Suffolk
Bradfield, Jas. B. Sanders...Stoke Ferry, Norfolk
Bradley, Edward...Traguff, Cowbridge, Glamorganshire
Bradley, John...Blyth, near Worksop, Notts.
Bradley, Thomas...Richmond, Yorkshire
Bradshaw, F., jun....Barton-le-Blount, near Derby
†Bradshaw, John...Knowle, Cranley, Surrey
Brady, Robert Watts...Kerdiston, Reepham, Norf.
Bragg, William...Cockermouth, Cumberland
Bragge, Colonel...Sadborough Park, Chard
Bragington, George...Torrington, Devon
Braithwaite, J....Orresthead, Kendal, Westmoreld.
Braithwaite, Septimus...Powell Villa, Weymouth
Brakenridge, John...Bretton Park, Wakefield
Bramwell, D. K....Funtington, Chichester
Brand, Henry...Glynde, Lewes
Brand, Thomas...The Hoe, Welwyn, Hertfordshire
†Brander, Robert Burnett...Essex Lodge, Norwood
Brandford, W. W....Godwick, Litcham, Norfolk
Brandram, John B....Chapmore End, Ware, Herts.
Branson, T...Norton Cottage, near Shiffnal, Shrops.
Branwhite, Chas. H...Gestingthorpe, Sudbury, Suff.
Brasnett, Thomas...Saham, Watton, Norfolk
Bravender, John...Cirencester
Brent, Dr....Sydney Cottage, Woodbury, Exeter
†Bretts, Chas....Exbury House, Fawley, Hants
Brewer, Edgar....The Maindee, Newport, Monmouthshire
Brewer, John...8, Upper Bedford Place, Russell Sq.
Brewit, Thomas...Rayleigh, Essex
Brewitt, John...Wickford, Ingatestone, Essex
Brewster, Joseph...Brewood, Penkridge, Staffordsh.
Brickwell, C....Overthorpe Lodge, Banbury, Oxon
Brickwell, John D....
Brickwell, William Henry..Leckhampstead, Bucks.
Bridge, Sealy...South Petherton, Somersetshire
Bridge, Thomas...Buttsbury, Ingatestone, Essex
Bridges, John...Westwood, Tuxford, Notts.
†Briggs, Rawdon....Birstwith Hall, Harrowgate, Yorkshire
†Briggs, Rawdon, jun.....Birstwith Hall, Harrowgate, Yorkshire
†Bright, J...Teddesley Park Farm, Penkridge, Staff.
Bright, John, M.D....19, Manchester Square
Bright, Joseph...Leamington, Warwickshire
Bright, Paul...Sheffield
Brigstocke, Rev. Augustus...Gellidywyll, Newcastle Emlyn, Carmarthenshire
Brigstocke, W. O.....Blaenpont, near Newcastle Emlyn
Brine, Rev. A. J...Boldre Hill, Lymington, Hamps.
Brine, W...Tolpuddle, near Dorchester, Dorsetshire
Brisco, Musgrave, M.P....Coghurst Hall, near Hastings, Sussex
Brise, John Ruggles...Spains Hall, Finchingfield, Braintree, Essex
Brittain, G. Dawes...Ercall Park, Wellington, Salop
Broade, P.B...Fenton Hall, Stoke-upon-Trent, Staffs.
Broadhurst, Thomas M... Brandiston, Woodbridge, Suffolk
Broadmead, Nicholas...Langport, Somerset
Brockman, F. H....Beachborough, Hythe, Kent
Brodhurst, J. E...Crow Hill, near Mansfield, Notts.
†Broke, Sir A. de Capell...Oakley, Kettering
Brokenbrow, Wm. Perrins...Beenham Farm, near Reading, Berkshire
Bromfield, W. Williams...Dunchurch, Warwickshire
Bromley, John...Derby
Bromley, Robert...Derby
Bromley, Rev. Walter Davenport...Wootton Hall, Ashbourne, Derbyshire
Bromwich, Thomas...Wolston, Coventry
Brook, Arthur Sawyer...Bexhill, Hastings, Sussex
Brook, Thos....Pencraig Court, near Ross, Hereford
Brooke, Edward...Burnage, Withington, Manchester
Brooke, James...Park Farm, Brading, Newport, Isle of Wight
Brooke, John William...Sibton Hall, Yoxford
†Brooke, Sir Rich., Bart....Norton Priory, Runcorn, Frodsham, Cheshire
Brooke, W...Babworth Cottage, near Retford, Notts
†Brooke, Wm. de Capell...The Elms, Market-Harborough, Leicestershire
Brooker, Pitman...Foot's Cray, Kent
Brookes, William...Elmstree, Tetbury, Glouc.
†Brooks, Bernard...Lyford, Abingdon, Berkshire
Brooks, Rev. Jonathan...Everton, near Liverpool
Brooks, Thomas...Croxby, near Caistor, Lincoln.
Broomhall, T. T...Beech Cliffe, Stone, Staffordshire
Bros, Thomas...16, St. James's Place
Brough, Wm....Shaw Farm, Overton, Wiltshire
Broughton, Richard N.... Llwynygroes, Llanymynich, Oswestry
Brouncker, Richard...Boveridge, Cranborne, Dorset
†Brown, Alex....Birely Grange, Wetherby, Yorksh.
Brown, Chas...Redbourn, St. Albans, Hertfordshire
Brown, David...Cathendine House, near Brecon
Brown, Edward...Harewood, Leeds, Yorkshire
Brown, Francis...Welbourn, Grantham, Lincolnsh.
†Brown, Frederick....King Street, Norwich
Brown, G....Avebury, near Marlborough, Wiltshire
Brown, Geo...Kingsley Cottage, Alton, Hampshire
Brown, Henry..Ashby-de-la-Zouche, Leicestershire
†Brown, Rev. H. H....Burton, Sleaford, Lincolnsh.
Brown, Henry Langford...Barton Lodge, Kingskerswell, Newton Abbot, Devonshire
Brown, Isaac..Cowpen Lodge, Blyth, Northumberl.
Brown, John...Compton, East Ilsley, Berkshire
Brown, John...Pear-tree Hill, Elm White Lion, Wisbeach, Cambridgeshire
Brown, John...Lower Upham Farm, Hogbourne St. George, Marlborough, Wiltshire
Brown, John...Wingerworth Hall, Chesterfield
Brown, John...Seaton Delaval Hall, North Shields, Northumberland

Brown, John Thomas...Pitt Street, Norwich
Brown, John W....Ufcott, near Swindon, Wiltshire
Brown, Joseph Lyne...Beaumont Cote, Barton-on-Humber
Brown, Rev. L. R....Kelsall, Saxmundham, Suffolk
†Brown, Potto...Houghton, near Huntingdon
Brown, Robert Jefferys...Cirencester
Brown, Thomas...Packington, Lichfield, Staffordsh.
†Brown, Thomas...Branbridge, Hand Cross, near Horsham, Sussex
Brown, Thomas C...Cirencester, Gloucestershire
Brown, William...Tring, Hertfordshire
Brown, William...Horton, Devizes, Wiltshire
†Brown, William...Richmond Hill, Liverpool
Brown, William...South Mills, Blunham, St. Neots
Brown, William...New Court, Ross, Herefordshire
Brown, William...Winterbourne Stoke, Salisbury
Browne, George Lathom ..3, Brick Court, Temple
Browne, John...Chisledon, Marlborough, Wiltshire
Browne, Rev. R. G. S...Atwick Vicarage, near Hornsea, E. R. Yorkshire
Browne, Rich...Duncombe Farm, Crediton, Devon
Browne, T. Beale...Salperton House, Andoversford, Gloucestershire
Browne, Rev. T. C...The Priory, Sydenham, Kent
†Browne, Wade...Monkton Farleigh House, Bradford, Wiltshire
Browne, William...Titchwell, Lynn, Norfolk
Browne, Wm....Stuckeridge Farm, near Tiverton, Devon
Brownlow, George...Woottondale, Barrow-on-Humber, Lincolnshire
Bruce, C. L. C., M.P...Dunphail, Forres, N.B.
Bruce, J...Tiddington, Stratford-on-Avon, Warwickshire
Bruges, William...Haxon, Pewsey, Wiltshire
Bruges, W. H. L., M.P...Seend, Melksham, Wilts
Bryan, Fred. Thomas...Knossington, near Oakham
Brymer, J...Burgate House, Fordingbridge, Hants
†Bubb, Anth...Witcombe Court, near Gloucester
Buck, James...Warham, Wells, Norfolk
Buck, William...East Farleigh, Maidstone
Bucke, L., M.P...Moreton House, Bideford, Devon
Buckland, George..Benenden, Cranbrook, Kent
Buckland, Thomas, jun...Wraysbury, Staines
Buckley, Col. Edwd. P....New Hall, near Salisbury
Buckley, John N...Normanton Hill, Loughborough, Leicestershire
Buckmaster, J. C....Parkhurst, Isle of Wight
Buggins, John...Sutton Coldfield, Birmingham
†Bulkeley, Sir Rich. W., Bart....Baron Hill, Beaumaris, Isle of Anglesey
Bull, Alban...Hanwell, Banbury, Oxon
Bull, Humphry...Aston Clinton, Tring
Bullen, John...Charmouth, Lyme Regis, Dorset
Buller, Sir A...Pound, near Plymouth, Devonsh.
Buller, James Wentworth...Downes, Exeter
Buller, John Buller Yarde...Churston Court, Torquay
†Buller, Sir John Buller Yarde, Bart., M.P...Lupton, Torquay
Bullimore, W...Witham, near Grantham, Linc.
Bulling, John...Great Tew, Enstone, Oxon
Bullock, Benjamin...Spital Hill, Morpeth
†Bullock, F...East Challow, Wantage, Berkshire
Bullock, Henry...Marden Ash, Ongar, Essex
Bulmer, Charles...Hereford
Bult, Jas. S...Dodhill House, Kingston, Taunton, Somersetshire
Bulwer, Rev. James...Aylsham
Bulwer, Wm. Lytton...Heydon Hall, Reepham, Norf.
Bunbury, H. M...Marlston House, Newbury, Berks
Bunny, Edward Brice...Speen Hill, Newbury
Burd, T...Whiston Priory, near Shrewsbury, Salop
Burden, Rowland...Castle Eden, Stockton-on-Tees, Durham
Burder, Alfred H...Hinnington, Shiffnal, Shropsh.
Burdon, George....Heddon House, Newcastle-on-Tyne, Northumberland
Burgam, H...Bickerton Court, Ledbury, Herefrdsh.
Burgess, Henry...29, St. Swithin's Lane, City
Burgess, James...Ridlington Park, Uppingham, Rutlandshire
Burgess, John....Muston, near Blandford, Dorset
Burgess, Joseph S...Holme Pierrepont, Notts.
Burgess, Robt...Winterbourne Zelston, Blandford, Dorsetshire
Burgess. Stephen...Westbrook, Lydd, Kent
Burgess, Wm...Wiggenhall, St. Mary Magdalen, Lynn, Norfolk
Burgoyne, Sir John M., Bart...Sutton Park, Biggleswade, Bedfordshire
Burke, J. French...William Street, Woolwich
Burn, Richard...Orton Hall, Penrith
Burn, William...Shirland, near Alfreton, Derbyshire
Burne, T. H....Loyriton Hall, Newport, Shropsh.
Burnell, Edward...Hanham, near Bristol
Burnell, Edward Pegge...Winkburne Hall, near Southwell, Notts.
Burnham, Geo....Wellingborough, Northamptonsh.
Burnham, James...Winwick, West Haddon, Northamptonshire
Burnham, Wm. Booth...Spital Farm, Lower Bebbington, Birkenhead
†Burr, Daniel Higford...
Burr, Edward...Dunstable, Bedfordshire
Burrard, Geo...Walhampton, Lymington, Hants
Burrell, Bryan...Broome Park, near Alnwick
†Burrell, Charles...Thetford
Burrell, James F., jun...Manor Farm, Frimley, Bagshot
Burrell, John...Fornham St. Martin, Bury St. Edmunds
Burrell, Robert...Durham
Burrell, Walton...Westley, Bury St. Edmunds
Burroughes, Hen. Negus, M.P....Burlingham Hall, Norwich
Burroughes, Rev. Jeremiah...Lingwood Lodge, Norwich
Burroughes, Rev. T....Gazeley, Newmarket
Burroughes, Wm...Burlingham, near Norwich
Burroughs, James Burkin...Burlingham Hall, Norwich
Burt, Henry...Gincocks Farm, Oxted, Surrey
Burt, Wm....Witchampton, Wimborne, Dorsetsh.
Burton David, jun...Cherry Burton, Beverley

Burton, Robert...Longnor Hall, Shrewsbury
Burton, Thomas, jun....Thurton, near Norwich
Burton, Thomas...Langley Grange, Loddon, Norf.
Burtt, James...Clenston, Blandford, Dorsetshire
Bury, Edward...Hanslope Park, Wolverton, Bucks.
†Bush, John Whittaker....Fairwood, Westbury, Wilts
Bushell, W...Poulton, Ash, Kent
Busk, E. Thos...Ford's Grove, Edmonton, Middlesex
Busk, Joseph...Little Birkhempstead, Hertfordsh.
Buston, Roger...Buston, near Alnwick
Butcher, Edward...Tring
Butcher, Richard...Longville, Wenlock, Salop
Butler, Ambrose E....19, Call Lane, Kepstearn, Kirkstall, Leeds
Butler, G...Bowling-green, Faringdon, Berks
†Butler, Henry...Tulse Hill, Brixton, Surrey
Butler, John...Caerleon, Newport, Monmouthshire
Butler, Capt. John...Kirby House, Inkpen, Hungerford, Berkshire
Butler, Major Robert...
Butler, Thomas...Walwick, Hexham
Butler, Thomas...Ewell Hall, Kelvedon, Essex
†Butterfield, C. Cotton....The Bank, Petersfield, Hants
†Butterfield, John Hen...Brackley, Northamptonsh.
†Buxton, Sir Edw. North, Bt.,M.P...Runcton, Norf.
Byron, Robert...Bradford, Yorkshire

Cadle, Joseph...Westbury-on-Severn, Gloucest.
†Calcraft, J. H...Kemstone, Corfe Castle, Dorset
†Caldecott, Thos...Rugby Lodge, Rugby, Warwicks.
Caldecott, William...Frating Lodge, Frating, Colchester
Caldicott, C.M...Holbrook Grange, near Rugby
Caldwell, H. B...Hilborowe Hall, Brandon
Caldwell, J. S...Linley Wood, Newcastle, Staffs.
Caldwell, Capt. William...3, Audley Square
Caley, Digby...Ripon, Yorkshire
Calhoun, W. F...Binderton, near Chichester, Sussex
Calvert, Edmund...Hunsdon, Ware, Hertfordshire
Calvert, Maj.-Gen. Felix...Hunsdon House, Ware, Herts.
†Calvert, Frederick...9, St. James's Place
Calvert, Dr. J. W....11, Blandford Pl., Regent's Park
Cambridge, William...Market Lavington, Devizes, Wilts
Cambridge, Wm....South Runcton, Downham Market, Norfolk
Camden, Marquis...Wilderness Park, Seven Oaks, Kent
Cammell, Charles...Wadsley House, Sheffield
Campbell, Rev. Chas....Weasenham, Norfolk
Campbell, Robert...Fakenham, Norfolk
Campion, Arthur...Circus, Exeter
Campion, Rev. C. H...Albourne Rectory, Hurstperpoint, Sussex
Campion, Edwd....Melchbourne, Higham Ferrers, Northamptonshire
Campion, Wm. J., jun...Danny, near Brighton
Cane, Rev. T. C...Southwell, Nottinghamshire
Cannon, Joseph Sims...Beckley, Oxford
Cantrell, Charles S., jun....Shaw Farm, Windsor, Berks.
Cantrell, Hy...Bayliss Court, Stoke, Slough, Bucks.
†Capel, Arthur....Bulland Lodge, Wiveliscombe, Somersetshire
Capel, Wm...The Grove, Stroud, Gloucestershire
Capper, Henry...The Willows, Coar's End, near Great Marlow, Bucks
Capron, George...Stoke, Northamptonshire
Carew, John F....Crowcombe Court, near Taunton, Somersetshire
†Carew, W. H. Pole...Anthony House, Devonport, Devon
Carey, John...Pylle House, Shepton Mallet, Soms.
Cargey, George...Sandon Hall Farm, Stafford
Carins, Michael...Meldon, Morpeth, Northumberl.
†Carleton, Hon. and Rev. Rd...25, Bruton Street
Carlin, Wm., jun...Haverfield, Pattrington, Hull
†Carline, R...Lincoln
Carlisle, Bishop of...Rose Castle, Carlisle
Carnac, Sir J. R., Bart...Warborne, near Lymington, Hants
†Carnarvon, Earl of...Highclere House, Newbury, Berkshire
Carnegie, Hon. J. J....Fair Oak, near Petersfield, Hampshire
Carpenter, John Nelson...Eardisland, near Leominster, Herefordshire
Carpmael, William...Streatham Hill, Surrey
Carr, George...Greenla Walls, Berwick-on-Tweed
Carr, John...Roseworth, Newcastle-on-Tyne
Carr, Ralph....Dunstan Hill, near Newcastle-on-Tyne
Carrington, Fred. A...10, Henrietta Street, Covent Garden
Carrington, Geo., jun...The Abbey, Gt. Missenden, Buckinghamshire
Carrington, John...Croxden, near Uttoxeter, Staffs.
Carrol, H...Tulla House, Nenagh, Tipperary
Carruthers, Dav...Grondra House, Chepstow, Monmouthshire
Carter, John... Scales Farm, Richmond, Yorkshire
Carter, John...65, Southmolton Street
†Carter, John Bonham...Ditcham Grove, Petersfield, Hampshire
Carter, J. R....Spalding, Lincolnshire
Carter, John Thomas...Hunstanton, Lynn, Norfolk
Carter, J. W....Little Totham Hall, Maldon, Essex
Carter, Thos....Styvechale, Coventry, Warwickshire
Carter, Thomas A....Lynn Regis, Norfolk
Carter, Thomas S...Moor Place, Much Hadham, near Ware, Hertfordshire
Carter, T. S....Watlington Park, Tetsworth, Oxon.
Cartlich, Thos....Chill Lodge, Tunstall, Staffordsh.
Cartwright, Geo...Cliff Cottage, Lyme Regis, Dorset.
Cartwright, Moses....Stanton House, Burton-on-Trent, Staffordshire
Cartwright, Nathaniel...Haugham, Louth
Cartwright, Richard Aubrey...Edgcott, Banbury
Cartwright, R. Norton...The Abbey, Ixworth, Suff.
Cartwright, Sir Thomas...Aynhoe Park, Brackley
†Cartwright, Thomas W....Ragnall Hall, Newton, Newark, Nottinghamshire

Cartwright, Col. W....Weedon, Northamptonshire
Carver, W. C....Melbourn, Royston, Hertfordshire
Carver, William...Ingarsby, near Leicester
Case, Frederick...Testerton House, Fakenham
Case, John Ashton...Hartham Park, Corsham, Chippenham
Castellain, Alfred...Liverpool
Castellain, Hermenegild...Belgian Consul, 3, Copthall Court
Castle, T...Worle, Weston-super-mare, Somersetsh.
Castlereagh, Viscount...25, Chesham Place, Belgrave Square
Castree, Josiah...Gloucester
Cathcart, Sir John Andrew...Cooper's Hill, Chertsey
Catherall, John...Mold, Flintshire, N. W.
Catlin, Thomas..Butley Abbey, Woodbridge, Suffolk
Cator, Capt. J. H....10, Wood Street, Woolwich
Cator, Col., R.H.A...Beckenham, Kent
Catt, Wm...Bishopstone, Newhaven, Sussex
†Caulfield, St. George...Wentworths, Chertsey, Surrey.
Caulton, John Thomas...Spalding, Lincolnshire
Cavan, Earl of...Barford House, Bridgewater
Cave, Sir John Cave Browne, Bart...Stretton-in-the-Fields, Ashby-de-la-Zouch, Leicestershire
Cavendish, Hon. F....Codicote Lodge, Welwyn, Herts
†Cavendish, Hon. Capt. G., R. N....Lyne Grove, Chertsey, Surrey
Cavendish, Hon. George H., M.P....Ashford Hall, Bakewell, Derbyshire
Cavendish, Hon. William Geo...Latimer, Chesham, Bucks.
†Cawdor, Earl of...74, South Audley Street
Cawley, James...Heath House, Runcorn, Cheshire
Cayley, E. S., M.P...Wydale, Malton, Yorkshire
Chadwick, E...4, Stanhope St., Hyde Park Gardens
†Chadwick, Elias...Pudleston Court, Leominster
Chaffey, R. T...Perridge House, Shepton Mallet
†Chafy, W. W....Connington House, St. Ives, Huntingdon
Chalcraft, W...Bramshot House, Liphook
Challenor, John...Blackwood, near Leek
Chamberlain, Hen...Bredicot Court, near Worcester
Chamberlain, Henry...Desford, near Leicester
Chamberlain, Robert...Norwich
†Chamberlayne, Thomas...Cranbury Park, Winchester, Hampshire
Chamberlin, Fred....Toft Monks, Norfolk
Chambers, George...High Green, Sheffield
Chambers, J...The Hurst, Tibshall, Alfreton
Chambers, Joseph...Wilne, near Shardlow, Derbysh.
Chambers, Thomas, jun....Colkirk, Fakenham
Chambers, William Frederick...Hordle Cliff, Lymington
Chambers, Wm., jun....Llanelly House, Llanelly, Carmarthenshire
Champion, F. B...Edale, near Castleton, Derbyshire
Champion, H...Ranby, near East Retford, Notts.
Champion, Rev. John...Taxal Rectory, Stockport, Cheshire
Champion, T. A...Sarr, near Margate, Kent
Champion, W...Bridge House, Worksop, Nottinghamshire
Champneys, Rev. T. Phipps...Snarleston, near Wakefield
Chandler, Henry...Salford, Manchester
Chandler, Thomas...Stockton, Warminster, Wilts.
Chaplin, F...Tathwell, Louth, Lincolnshire
Chaplin, W. Jas., M.P....Ewehurst Park, Basingstoke
Chapman, Benjamin...Lambcroft, Skelton, Guisborough
Chapman, George...3, Arundel Street, Strand
Chapman, Thos...Stoneleigh, Coventry, Warwicksh.
Chapman, Thomas...Esher Lodge, Esher, Surrey
Chapman, Thomas...3, Arundel Street, Strand
Chapman, T. S. ... Aston Clinton, near Tring, Herts.
Chapple, William...Gornhay, Tiverton
Chare, Robert...Buckland Marsh, Faringdon, Berks
Charleton, Charles Forster...Alndike, near Alnwick
Charlton, P...Withyford Hall, Shrewsbury, Shrops.
†Charlton, St. John Chiverton...Apley Castle, Wellington, Shropshire
Charlton, Thos. P...Hilden, near Tonbridge, Kent
Charlton, W. H....Hedleyside, Hexham
Charnock, John Henry...Copmanthorpe, near York
Charrington, Nicholas...Leytonstone, Essex
Charteris, Hon. F., M.P....Armisfield, Haddington, N. B.
Chasemore, P...Horsham, Sussex
Chatterton, Richard..Hallington, Louth, Lincolnsh.
Chatterton, William....High Risby, Barton-on-Humber
Chattock, J...Hay House, Castle Bromwich, near Birmingham
Chawner, Henry...Hound Hill, Uttoxeter, Staffs.
Chawner, Rich...Sudbury, Derbyshire
†Chawner, Richard Croft...Wall, Lichfield, Staffs.
Cheale, Alex. J....Uckfield, Sussex
Cheatle, Farmer...Dosthill, Fazeley, Staffordshire
Cheere, Rev. G...Papworth Hall, Caxton, Cambs.
Cheere, W. H...Papworth Hall, Caxton, Cambs.
Cheese, John...Castle Weir, Kington, Herefordshire
Cheffins, H....Little Easton Manor, near Dunmow, Essex
Cheney, Edward...Gaddesley Hall, Melton Mowbray
Cheney, R. H...Badger Hall, near Shiffnal, Shrops.
Cherry, Alfred Henry...Clapham, Surrey
Cherry, George H...Denford, Hungerford, Berks.
Chester, Thomas....Haven Farm, near Tickhill, Bawtry, Nottinghamshire
Chetwode, Sir John Newdigate Ludford, Bart.... Ansley Hall, Atherstone, Warwickshire
Chetwynd, William Henry...Longdon, Lichfield
Chetwynde, Major Wm. Fawkner...Brocton Hall, near Lichfield, Staffordshire
Chichester, Bishop of...Palace, Chichester, Sussex
Child, Thos....Michelham Priory, Hailsham, Sussex
Child, Rev. V. Knox...Takeley, Dunmow, Essex
Child, Wm...Wigmore Grange, Ludlow, Shropshire
Child, Wm....Vernham Manor, Andover, Hants.
Chitty, Edward...Guildford, Surrey
Cholmeley, Henry...Brandsby, near York

†Cholmeley, Sir M. J., Bart.... Easton Hall, Colstersworth, Lincolnshire
Cholmeley, Waldo.... Staincross, near Barnsley, Yorkshire
†Cholmondeley, Lord H.. .Holly Hill, Southampton
Chouler, Chas.... Wollaton, near Nottingham
Choyce, W.... Ham's Bridge, Atherstone, Warw.
Chrisp, Thomas... Hawkhill, Alnwick, Northumb.
Christian, John Robert.... 16, St. Mary Abbott's Terrace, Kensington
Christie, Langham... Preston Deanery, Hackleton, Northampton
Christmas, James... Hayling, near Havant, Hants.
Chune, Geo.... Coalbrookdale, Salop
Church, John... Woodside, Hatfield
†Churchill, Geo.... Buckland-Reapers, Dorchester, Dorsetshire
Churchill, Henry.. Barton House, Morshard Bishop, Exeter
Churchward, Henry.... Stone House, Brideslow, Oakhampton, Devon
Churchyard, Isaac... Petistree, Wickham Market, Suffolk
†Churton, John... Foregate Street, Chester
Chute, W. L. Wiggett, M.P.... The Vine, Basingstoke, Hants
Clare, W. H... Twycross, Atherstone, Leicestershire
†Clarina, Lord... Elm Park, Limerick, Ireland
†Clark, Edwin... Ellinthorpe Hall, Boroughbridge, Yorkshire
Clark, Geo. ... Hyde Hall, Sandon, Buntingford, Herts.
†Clark, Heaton.. Ellinthorpe Lodge, near Boroughbridge, Yorkshire
†Clark, James... Chapel Farm, Burley, Oakham, Rutlandshire
Clark, Rev. John Crosby... Chertsey, Surrey
Clark, John Wm... Timsbury Farm, Romsey, Hants.
Clark, Joseph... Maidenhead, Berkshire
Clark, N., jun. .. Urpeth, Chester-le-Street, Durham
Clark, Thos., jun.... Derndale, near Hereford
Clark, Wm. John... Buckland Toutsaints, Kingsbridge, Devon
Clarke, Charles... Aisthorpe, near Lincoln
Clarke, Sir C. Mansfield, Bart., F.R.S.... Wigginton Lodge, Tamworth
Clarke, Edward... Canwick, near Lincoln
Clarke, George Rochfort.. Chesterton Lodge, Bicester
Clarke, Jno... Long Sutton, Lincolnshire
Clarke, John Altham Graham... Kinnersley Castle, Hereford
Clarke, Joseph, jun.... Waddington Glebe, Lincoln
Clarke, R. Trevor... Welton Place, Daventry
Clarke, Thos. Truesdale... Swakeleys, Uxbridge
Clarke, W. R.... Wymondham, Norfolk
†Clavering, W.... University Club, Suffolk Street
Clay, John... East Boldon, near South Shields
†Clay, Sir William, Bart., M.P.... Fulwell Lodge, Twickenham, Middlesex
Clayden, John... Littlebury, Saffron Walden, Essex
Claydon, Charles... Cambridge
Claypon, Joseph.. 9, Westbourne Street, Hyde Park Gardens
Clayton, David S.... Norbury, near Stockport, Ches.
Clayton, Hy... 21, Upper Park Place, Dorset Square
Clayton, John... Chesters, Hexham
Clayton, Nathaniel... Melvell Street, Lincoln
Clayton, R. C. B.... Adlington Hall, Wigan, Lanc.
Cleave, Benjamin... Newcombe, Crediton, Devon
Clement, Hampden... Snareston Lodge, Atherstone, Warwickshire
Clement, W. J.... Shrewsbury
Clerk, Edmund Hugh.. Westholme House, Shepton Mallet, Somersetshire
Clerke, Rev. Francis.. Eydon, Brackley, Northamp.
Cleveland, Augustus... Tapley Park, Barnstaple
Cleveland, Duke of.. Newton House, Bedale, Yorks.
Clifford, Henry Clifford... Frampton Court, Dursley
Clifford, Hy. Morgan... Llantilio, Crosseney, Ragland, Monmouthshire
Clinton, Colonel F.... No. 1, Haymarket
Clinton, Lieut.-Col. H.... 6, Audley Square
Clinton, Lord.. .Hinton House, Hatherleigh, Devon
†Clive, Rev. Archer.. Solihull Rectory, Warwicksh.
Clode, John ... Great Linford, Newport Pagnell, Bucks.
†Clonbrock, Lord ... Clonbrock, Ayaseragh, Ireland
Clough, John... Bootham, York
Clover, John... Kirtling Place, Newmarket, Cambs.
†Clowes, Edmund.. .Warton, Lancaster
Clowes, Wm. Leigh... Spondon, near Derby
Clutterbuck, Rev. Jas. Charles... Long Wittenham, Abingdon, Berkshire
Clutterbuck, Robert ... Watford House, Watford, Herts.
Clutton, John... 8, Whitehall Place
Clutton, Robert... Hartswood, Reigate, Surrey
Clutton, Thos. C.... Chorlton Hall, Malpas, Chesh.
Clutton, Wm.... Edwinstone, Ollerton, Notts.
Clutton, Wm. James... The Mount, York
Coape, Capel... Union Club
Coape, H. Coe... Maldon, Essex
†Cobb, Henry... 18, Lincoln's Inn Fields
Cobb, Robt.... Town Place, Faversham, Kent
Cobb, Robt. L.... Higham, Rochester
Cobbold, John Chevallier, M.P.... Ipswich, Suffolk
Cobham, T.... Marley Lodge, near Exmouth, Devon
Cobon, James... Well Hall, Lynn, Norfolk
Cock, Wm.... Courtledge, Appledore, near Tenterden, Kent
Cockell, Charles... Bridgham, East Harling, Norf.
Cockeram, Thomas... Up Cerne House, near Dorchester, Dorset
Cocks, Rev. W.... Neen Savage Rectory, Cleobury Mortimer, Salop
Coe, Robert, jun.... Tilney, Lynn, Norfolk
Cogan, Thos. S.... Eastdean, Chichester, Sussex
†Colborne, Lord... West Harling, Norfolk
Colchester, Benjamin... Ipswich
Coldham, H. W.... Anmer, near Lynn, Norfolk
†Cole, Richard John... Chertsey, Surrey
Cole, T. H... The Green, Wick, near Bath, Somerset
Cole, William Henry... Pulham, Harleston
Coleman, John... Kearsney Court Farm, near Dover
Coleman, John... Runhall, Wymondham, Norfolk
Coleman, Richard... Langdon Abbey, Dover, Kent

†Coles, Alfred...Snelsmore, Newbury, Berkshire
Coles, Colonel...Kean Hall, Wells, Somerset
Coles, Colonel...Woodcote, Alresford, Hants.
Coles, H. B...Middleton House, Whitchurch, Hants.
Collard, Edwin...Chislett Park, Chislett, Canterbury, Kent
Collard, Thomas W....Canterbury, Kent
Collett, Russell...The Jungle, near Lincoln
Colley, John...Osbaston, Wellington, Salop
Collier, John...Panlathy, Muirdrum, Forfarshire, N. B.
Collin, Rev. John, jun....Rickling Vicarage, near Bishop Stortford, Herts.
Collings, Daniel Harson...Sneed Park, near Bristol
Collingwood, Edward...Tissington Hall, Newcastle-upon-Tyne
†Collins, Henry. . Berkeley Lodge, near Chichester
†Collins, John...Wonham, Bampton, Devon.
Collison, Brown . . New England, Hitchin, Herts.
Collyer, Rev. R...Warham Rectory, Wells, Norf.
Colquhoun, J. C., M.P....8, Chesham Street
Colthurst, Jonathan...Hantworth Park Farm, Bridgewater, Somersetshire
Coltman, Wm. Joseph...Alborough Hall, Boroughbridge, Yorkshire
Colvile, Rev. A. Asgill...Livermere Rectory, Bury St. Edmunds
Colvile, Col....12 a, Great Cumberland Place
†Colvin, Beal Blacknell..Monkhams Hall, Waltham Abbey, Essex
†Colyer, William...North End, Crayford, Kent
Combermere, Viscount..Combermere Abbey, Nantwich, Cheshire
Comins, James...South Molton, Devonshire
Comins, Richard...Tiverton, Devon
†Commerell, Will. Augustus...Strood, Horsham
†Compton, Henry Combe, M.P....Minstead Manor House, Lyndhurst, Hants.
†Compton, Richard...Eddington House, Hungerford, Berkshire
Connell, Dr....2nd Life Guards
Connop, N. ...Honeylands, Waltham Abbey, Essex
Conroy, Sir J., Bart., K.C.H..Arborfield Hall, Reading
Conway, Wm. Shipley...Bodryddan, St. Asaph's, Flintshire, N.W.
Cooch, Joshua...Harleston, near Northampton
Coode, Geo....Haydock, Newton-le-Willows, Lanc.
Cook, Charles...High House, Litcham, Norfolk
Cook, Henry G....Lacton Hall, Willesborough, near Ashford, Kent
Cook, Rev. J. G....Purley Hall, nr. Reading, Berks.
†Cook, John...Hothorpe, Welford, Northamptonsh.
Cook, William, jun....Orton, Rowell, Kettering
Cooke, Rev. Jas. Y....Semer, near Hadleigh, Suff.
Cooke, John...Flemston Hall, Bury St. Edmunds
Cooke, John Malsbury...Towcester, Northamptonsh.
†Cooke, P. D....Owston, near Doncaster, Yorksh.
Cooke, Thomas...Newport, Monmouthshire
Cooke, Wm....Catraw, Stannington, Morpeth
Cooke, Wm....Camerton Hall, Workington, Cumb.
Cooke, Wm....Risby Hall, Bury St. Edmunds
Cooke, Sir Wm. B., Bart.....Wheatley Hall, Doncaster, Yorkshire
†Cooke, Wm. Fothergill...Eliot House, Blackheath
Cookson, Charles Edward...Newcastle-upon-Tyne
Cookson, I....Meldon Park, Morpeth, Northumb.
Cookson, John...Hatherton, near Nantwich
Cookson, Thomas...Swinburne Castle, Hexham
Cookson, Wm....Benwell Hall, Newcastle-on-Tyne
Cooling, John...Lower Winchindon, Thame, Oxon.
Cooper, Geo. F....Langenhoe Hall, near Colchester, Essex
Cooper, G. Kersey...Euston, Thetford, Norfolk
Cooper, I....Long Brackland, Bury St. Edmunds, Suffolk.
Cooper, J. G....Blythburgh, near Halesworth, Suff.
Cooper, Jonathan...Barton, Bury St. Edmunds.
Cooper, Lewis Judah...23, Broad Street, Reading
Cooper, Samuel, jun....Ardleigh, Colchester, Essex
Cooper, Thos....Norton Seaford, near Lewes, Suss.
Cooper, Thomas...Ashford, Bakewell, Derbyshire
Cooper, Thomas H...Camden Street, Camden Town
Cooper, William...Barningham Park Farm, Ixworth
Cooper, William D. C....Toddington Manor, near Dunstaple, Beds.
Cooper, William Henry...Shrewsbury
Cope, Sir John...Bramshill, Hartford Bridge, Hants.
Copeman, George...Aylsham
Copeman, Robert, jun....Hemsby, Great Yarmouth
Copeman, Thomas...Aylsham, Norfolk
Copestake, Thos. G....Kirkby Langley, near Derby
†Coppard, Thomas...Horsham, Sussex
Corbet, Andrew W....Sundorne Castle, Shrewsbury
Corbet, Sir A. V., Bt....Acton Reynald, Shrewsbury
Corbett, Edward...Longnor Hall, Shrewsbury
Corbett, James...The Sheriff's Farm, Pembridge, Herefordshire
Corbett, Rev. Joseph...Tugford, Ludlow
Corbett, Vincent...Worthy, near Sheffield
Cornes, John...Barbridge, Nantwich
Cornewall, Sir Velters, Bart....Moccas Court, near Hereford
Cornwallis, Earl of...Linton Place, Staplehurst, Kent
Corrance, Fred....Lowdham, Woodbridge, Suffolk
Corringham, R. W....Gringley-on-the-Hill, near Bawtry, Notts.
Corsbie, John...Horrenger, Bury St. Edmunds
Cosens, William...Langdon, Dawlish, Devon
Cotes, Rev. Chas. Grey...Stanton St. Quintin, Chippenham, Wilts.
Cother, William...Middle Aston, Woodstock, Oxon.
Cottam, Geo....Winsley Street, Oxford Street
Cottenham, Lord...Coppice Hill, Wimbledon, Surr.
Cotterell, Jacob Henry...Bath
†Cottingham, Edmund...Chunb Farm, Cove, Hythe, Wrentham
Cottingham, John G....Chesterfield, Derbyshire
Cottingham, L. O....Reydon, Southwold, Suffolk
Cottle, W....Cheney Court, Box, near Chippenham
†Cotton, Alexander...Hildersham Hall, Cambridge
Cotton, Chas. Robert...Broughton Hall, Worthenbury, near Wrexham
Cotton, H....Amor Hall, Washbrook, Ipswich, Suff.
Cotton, W. A....Ellesmere, Salop
†Coudie, James...Perth
Coulman, Robt. Jno....Wadworth, Doncaster, Yorks.

Coulson, Col....Blenkinsopp, Haltwhistle, Northum.
Coulson, John, jun....Kenninghall, Harling, Norf.
Coupland, J....Southampton
Coupland, John Geo....Freeston, Boston, Linc.
†Courtenay, Viscount, M.P....Powderham Castle, Exeter
Courthorpe, G. C....Whyly, Lamberhurst, Sussex
Coussmaker, Lannoy...Westwood, Farnham, Surrey
Coward, Charles Leach...Masbro', Rotherham
Cowen, Joseph...Blagdon Burn, Newcastle-on-Tyne
Cowper, Earl...1, Great Stanhope Street
Cox, E. W....Haddenham, Aylesbury
†Cox, Henry...Trevereux, Edenbridge, Kent
Cox, John Henry...Parkfield, near Derby
Cox, Samuel Walker...Breadsall, near Derby
Cox, Thomas...Walton Hill, Burton-on-Trent
Cox, William...Brailsford, near Derby
Cox, William...Scotch Grove, Thame
Cox, Wm. Thos....Cottage, Spondon, near Derby
Coxe, Francis L....Wye Cottage, near Chepstow
†Coxe, James...Newtown Lodge, Hungerford
Coxe, Philip S....Ardington Mill, Wantage, Berks.
Coyney, Chas....Weston Coyney, Newcastle-under-Lyme, Staffordshire
Cozens, Robt....Norton Farm, Sutton Scotney, Winchester
Cozins, John...Wraxhall House, Charlton Kings, Cheltenham
Crabtree, John...Halesworth, Suffolk
Cradock, S....Hartforth Hall, Richmond, Yorkshire
Cradock, Thos....Woodhouse, Loughborough, Leicestershire
Craig, John...Quatt, Bridgnorth
†Crallan, Thomas...3, Ardwick Green, Manchester
Crane, Henry...Oakhampton, Stourport, Worcestershire
Crane, Jno....
Crawford, Rev. W. H....Haughley Park, Woolpit, Suffolk
Crawford, William...Newton Purcell, near Bicester
Crawhall, Isaac...White House, Stanhope, Durham
Crawhall, Joseph...Newcastle-upon-Tyne
†Crawhall, William...Stagshaw Close House, Hexham, Northumberland
Crawter, Henry...7, Southampton Buildings, Chancery Lane
Crawter, Thomas...Cobham, Surrey
Cree, John...Ower Moign, Dorchester, Dorset
Creed, George...Boarhunt Farm, Fareham, Hants
Cresswell, A. J. Baker, M.P....Cresswell, near Morpeth, Northumberland
Cresswell, Oswin A. Baker..Cresswell, near Morpeth
Cresswell, Robert...Idridgehay, near Wirksworth, Derbyshire
Cresswell, William G. Baker...Cresswell, near Morpeth
Cretney, Thomas...Dunsfold, Godalming
Cripps, J. Martin..Novington, Hurstperpoint, Sussex
Cripps, Thomas...Oxford
Crisp, Fortunatus...1, Smith Terrace, Smith Street, Chelsea
†Crisp, Thos....Gedgrave Hall, Woodbridge, Suffolk
Crispin, Henry, jun....Chumleigh, Devon
Crockford, Henry...Dee Cottage, Queen's Ferry, Flintshire
Crockford, Rev. William John...The Vicarage, Moreton Say, Market Drayton
Croft, Archdeacon James, M.A....Saltwood, Hythe, Kent
Croft, Sir J., Bart...Millgate Lodge, near Maidstone
†Crofton, Lord...Mote Park, Athlone, Ireland
Crofton, Thos...Holywell, Durham
Croggon, T. J....8, Laurence Pountney Hill, Cannon Street, London
Crompton, Joshua Samuel...Sion Hill, Thirsk
Croome, James...Breadstone, Berkeley, Gloucesters.
Croote, William, jun....Lapford, Chumleigh, Devonshire
Crosby, John...Kirkby Thore, Appleby, Westmoreland
Crosland, J. S....Burbage House, Hinckley
Cross, John...Ely
Cross, William Assheton...Red Scar, near Preston, Lancashire
Crosse, Henry...Boyton Hall, Stowmarket, Suffolk
Crosse, James...Gringley, Retford, Notts.
Crosse, William...One House Hall, Stowmarket
Crosskill, William...Beverley, Yorkshire
Crossley, J...Scaithcliffe, near Todmorden, Lancs.
Crosthwaite, John...Much Wootton, near Liverpool
Crouch, James...Cainhoe, Silsoe
Crouch, John...Cirencester
Croughton, William Peel...Heronden House, Tenterden, Kent
†Crow, G...Ornhams, Boroughbridge, Yorkshire
Croxon, John...Llanforda Isaf, Oswestry, Shropsh.
Crump, Jos....Wooler's Hill, Tewkesbury
Crundwell, George...Manor House, Southborough, Tunbridge Wells
Cruso, John, jun...Leek, Staffordshire
Crutchley, Percy H....Sunning Hill Park, Chertsey, Surrey
Cubley, Tamberlain...Quarrington, Sleaford, Lincolnshire
†Cuff, W. F...Merriott, Ilminster
Culley, John, jun...Guton Hall, Norwich
Cullum, S...Townsend Farm, St. Albans, Herts
Culverwell, J...Wedmore, near Wells, Somerset.
Cummins, Thomas...Gateshead
Cunliffe, Sir Robert, Bart....Acton Park, Wrexham, Denbighshire, N.W.
Cuninghame, John...Hensol, Castle Douglas, Kirkcudbright, N.B.
†Cure, Capel...Blake Hall, Ongar, Essex
Cureton, George...Westbury, Salop
Cureton, John...Hordeley, Ellesmere, Salop
Curl, Jacob...East Winch, Lynn Regis
Currie, Edmund...Oakley House, Abingdon, Berks.
Currie, H...West Horsley Park, Leatherhead, Surrey
Currie, Jas...Hillside, King's Langley, Herts
Currie, Raikes, M.P. . 4, Hyde Park Terrace
Curteis, George...Canterbury
Curties, Rev. Thomas Chandler...Linton Vicarage, Ross
Curtis, Edward...New Barn Farm, Gatcombe, Newport, Isle of Wight

Curtis, Admiral Sir Lucius, Bart...Gatcombe House, Portsmouth, Hampshire
†Curtis, Sir William, Bart....Ramsgate
Curtler, T. G...Bevere House, near Worcester
Custance, H. F...Weston House, Norwich
Cuthbert, James...12, Clayton Square, Liverpool
Cuthbert, William...Beaufront, Hexham
†Cuthbert, William, jun....Beaufront, Hexham

Dadds, James...Wingham, Kent
Dadds, John, sen...Wingham, Kent
Daintree, R...Hemingford Abbots, St. Ives, Hunts.
Daintry, T. R...North Rode, Macclesfield, Cheshire
Dalgairns, William...Guernsey
Dalton, James...Bures, near Colchester, Essex
Dalton, John...West Bilney, Lynn
Dalton, Rev. William...Swaffham
Damen, Angel...Isle Brewers, Langport, Somerset
Damen, John Angel...New Farm, Winforth, Dorchester, Dorset
Damer, Hon. Dawson...Rectory, Church Street, Chelsea
Dand, Robert...Field House, Alnwick
Dandridge, Daniel...East Hendred, Abingdon, Berks.
†Daniel, John...Parson's Green, Middlesex
Daniel, Thos., jun...Stoodley, Tiverton, Devonshire
Daniel, William...Burton-on-Trent, Staffordshire
Darby, George, M.P....Marklye, Warbleton, Hurst Green, Sussex
Dare, R. W. Hall...Rossana, Ashford, Ireland
Darley, Charles Albert...Burtonfield, near York
Darling, Geo...Hetton House, Wooler, Northumb.
Darling, Thomas....Beau-Desert Farm, Lichfield, Staffordshire
Darnell, Thos. Smith...St. Neots, Huntingdonshire
†Dartmouth, Earl of...Sandwell Park, Birmingham
Darton, Thos. H.....Temple Dentley, Hitchin, Hertfordshire
Dartry, Lord...Dartry, Rockcorry, Ireland
Dashwood, Francis...Halcott, Bexley, Kent
Dashwood, Henry...Kirtlington, Gosford, Oxon
Daubeny, Rev. Edw. A...Ampney, near Cirencester, Gloucestershire
Daubuz, J. B...Offington House, Worthing, Sussex
Davenport, Edward...Spurstow Hall, Bunbury, Tarporley, Cheshire
Davey, George...Dorchester, Oxon.
Davey, George, jun...Buckland, Faringdon, Berks.
Davey, Richard...Redruth, Cornwall
David, Evan...Fairwater, Cardiff, Glamorganshire
Davidson, A. D. Greaves...Hylton Grove, West Boldon, Gateshead
Davidson, Thomas Atkinson...Police Office, Newcastle-upon-Tyne
Davidson, Wm....Scotter, Gainsborough, Lincolnshire
Davie, Sir H. Ferguson, Bart...Creedy, Crediton
Davies, D. S., M.P....Pentre, Newcastle Emlyn, Carmarthenshire
Davies, James...Foschydgaled, Aberystwith
Davies, John...Halford, near Ludlow, Salop
Davies, Rev. Lewis Charles...Ynishir, Aberystwith
Davies, Rev. R. W. P..Court-y-Gollen, Crickhowell, Brecknockshire
Davies, Rev. S...The Grange, Oystermouth, Swansea
Davies, Mrs. Susanna...Rochlaveston Manor, Nottingham
Davis, Cornelius Butler...East Woodhay, Newbury
Davis, Hy...Old Downs, Oakhill, nr. Bath, Somerset.
Davis, Major H. T...Waterhouse, near Bath, Somerst.
†Davis, John...Cranbrook, Ilford, Essex
Davis, John...Banbury, Oxfordshire
Davis, John...Maperton, Wincanton, Somersetshire
Davis, Peter...Milton House, Pembridge
†Davis, Richd....Skeynes, Edenbridge, Kent
†Davis, Samuel...Swerford Park, Enstone, Oxon
Davis, Thos..Little Wenlock, Wellington, Shropsh.
†Davis, Thos. Henry...Orleton, near Worcester
Davison, Thomas...Durham
Davison, William...Seaton Delaval, North Shields
Davy, Francis...Topsham, near Exeter, Devonshire
Davy, H...Warsop, nr. Mansfield, Nottinghamshire
Davy, James...Churchill, Broad Clist, near Exeter
Davy, John...Owersby, Market Rasen, Lincoln
Davy, John T...Barton, Roseash, nr. South Molton
Davy, Joseph...Kelling, Holt, Norfolk
Davy, Robert...Ringwood, Hampshire
Davy, Walker...Thorseway Vale, Caistor, Lincolnshire
Dawes, Edward Nathaniel...Rye, Sussex
Dawkins, Henry...Encombe, Folkestone, Kent
Dawson, Edward...Aldcliffe Hall, Lancaster
†Dawson, Edward...Long Whatton House, near Loughborough, Leicestershire
Dawson, G. P...Osgodby Hall, Selby, Yorkshire
†Dawson, H...Launde Abbey, Uppingham, Rutld.
Dawson, J...Gronant, Holywell, Flintshire, N. W.
Dawson, William...High Street, Bedford
†Dawson, William Edward..Plumstead Common, Kent
Day, Francis...Priory, St. Neot's, Hunts.
Day, John...Newick, near Lewes, Sussex
Day, John Woodhouse...Pelau House, Durham
Day, Thomas...Wornditch, Kimbolton, Hunts.
Day, William...St. Neots, Huntingdonshire
Dayman, John...Trebarfoot, Stratton, Cornwall
Dean, Alex...Pershore Road, Smithfield, Birmingham
†Dean, A. Keball...East Brent, Axbridge, Somerset.
†Dean, F. Keball...East Brent, Axbridge, Somerset.
Dean, G. A...Stratford, Essex
Dean, Henry...Weston, Petersfield, Hampshire
Dean, James...The Yews, Tottenham, Middlesex
Dean, John...Peterborough, Northamptonshire
Deane, George...46, King William Street, City
Deane, John...46, King William Street, City
Dearden, Jas...Rochdale, Manchester, Lancashire
De Berg, M...30, Dover Street, Piccadilly
De Broke, Lord Willoughby...Compton Verney, Stratford-on-Avon
Deedes, William...Sandling Park, Hythe, Kent
De l'Isle and Dudley, The Earl of...Penshurst, Kent
Dell, Thos...Broadway Farm, Great Berkhampstead, Hertfordshire
Delves, William Frank...Tonbridge Wells

†De Mauley, Lord...Canford House, Wimborne, Dorsetshire
†Denbigh, Earl of...Newnham Paddock, Lutterworth, Leicestershire
Denison, Edmund...Doncaster
†Dennett, Mullens...Lodsworth, Petworth, Sussex
Dennis, Robert...Greetham, Horncastle, Lincolnsh.
Dennison, William, jun....Redbrook Manor Farm, Blackheath
Dent, John...Worcester
Dent, John...Streatlam Castle, Barnard Castle
Dent, Joseph...Ribston Hall, Wetherby, Yorkshire
Dent, Ralph...Streatlam Castle, Barnard Castle
Dent, Villiers...Avon Cottage, Ringwood
Dent, William...Brampton, North Huntingdon
Denton, Thomas...Lew, Witney, Oxfordshire
Derry, Charles M...Gedney, Holbeach, Lincolnshire
Dester, Joseph...Bramcote, Tamworth, Staffordshire
Des Vœux, Henry...Drakelow Park, Derby
Devas, Thomas...Dulwich, Surrey
Deverell, John...Purbrook Park, Portsmouth
Devon, Charles...Teddington Place, Middlesex
Devon, Earl of...Powderham Castle, Exeter, Devon.
Dew, J...Cradock, Ross, Herefordshire
Dew, Tomkins...Whitney Court, Hereford
Dewey, Lewis...Woodcock Lodge, Little Berkhampstead
Dewing, Augustus...Ash Wicken, Lynn Regis
†Dewing, R...Carbrooke, Watton, Norfolk
De Winton, J. Jeffrys...Priory Hill, Brecon
De Winton, J. Parry...Maesderwen, Brecon, S. W.
†Dickens, Charles Scrace...Horsham, Sussex
Dickin, John...St. John's Hill, Shrewsbury
Dickins, Robert A...Woodford Grange, Wolverhampton, Staffordshire
†Dickinson, E. H.....King's Weston, Somerton, Somersetshire
Dickinson, Harvey...Sundridge, near Sevenoaks, Kent
Dickinson, Henry...Severn House, Colebrook Dale, Salop
Dickinson, John...Abbot's Hill, Watford, Herts.
Dickinson, John...Red How, Cockermouth
Dickinson, Joseph...Westbury, Salop
Dickinson, William...7, Curzon Street, May Fair
Dickinson, Wm. Lindow..Workington, Cumberland
Dickon, Thomas...Doncaster
Dickons, Thomas...High Oakham, Mansfield
Dickson, James...Chester
Dickson, John...Peelwalls, Ayton, Berwickshire
Dickson, Robert....East Wickham, near Welling, Kent
Didsbury, Thomas...Rotherham, Yorkshire
Digby, E...Minterne House, Dorchester, Dorsetshire
Digby, Rev. K...Tetteshall Rectory, Litcham, Norf.
Digby, Lieut.-Col. Robt. ..6, Chapel Street, Grosvenor Square
Dighton, Francis...Northallerton, Yorkshire
†Dilke, Capt., R.N....Maxstoke Castle, Coleshill, Warwickshire
†Dilke, C. Wentworth...76, Sloane Street
Dilke, C. W....9, Lower Grosvenor Place
Dinning, John...Newlands, near Belford
Disbrowe, Sir Edward Cromwell...the Hague
†Divett, E., M.P...Bystock, Exmouth, Devonshire
Dix, Robert...Stamford Rivers, Romford
Dixon, Charles...Stanstead Park, Chichester, Sussex
Dixon, Henry...Witham, Essex
Dixon, Henry...Oxford
Dixon, James...Page Hall, near Sheffield, Yorksh.
Dixon, John...Harmston, near Lincoln
Dixon, John...Knells, Carlisle
Dixon, John Bond...Freechase, Slangham, Sussex
Dixon, J. G....Caistor, Lincolnshire
†Dixon, John William...Beasby, North Thoresby, Louth
Dixon, Peter...Holme Eden, Carlisle
Dixon, Thomas....Darlington, Durham
Dixon, Thomas J....Holton, near Caistor, Lincolnshire
Dixon, William Frederick ... Birley House, near Sheffield
Dobito, Geo....Kirtling Hall, Newmarket, Cambs.
Dobree, Harry...Beau Séjour, Guernsey
Dobson, William...Tritlington, Morpeth
Dod, J. Whitehall, M.P....Cloverley Hall, Whitchurch, Shropshire
Dod, Henry D....Mansfield Woodhouse, Notts.
Dodd, Thomas...Rainham, Sittingbourne, Kent
Dodds, Ralph ... 32, Prudhoe Street, Newcastle-upon-Tyne
Dodds, Thomas...Standish, Wigan, Lancashire
Dolby, Charles...Spalding, Lincolnshire
Dolby, Wm....Marston, Grantham, Lincolnshire
†Dollond, Geo....North Terrace, Camberwell
Dolphin, Thos....Swafield, North Walsham, Norf.
Domett, Samuel...Westhay, Axminster, Devon
Domvile, Charles Compton William...Hampreston Rectory, Wimborne
Donkin, Edward...Westow, near York
Donkin, Geo....Wyfold Ct., Henley-on-Thames
Donkin, Samuel...Bywell, Felton, Northumberland
Donkin, Thos....Westow Hall, Whitwell, near York
†Donovan, George...Buckham Hill, Uckfield
Dorchester, Lord...Greywell, Odiham, Hants.
Dormer, C. Cottrell...Rousham, Woodstock, Oxon.
†Dorrien, Charles...Sennecotes, Ashling, near Chichester, Sussex
Dougill, John...Finthorp, near Huddersfield
Douglas, Rev. H. Cockburn ... Duntze, Weaverthorpe, Sledmere, Yorkshire
Douro, Marquis of, M.P. ... 3, Upper Belgrave Street, Belgrave Square
Dover, Henry...Caston, Watton, Norfolk
Dowden, Thos....Mitcheldever, near Winchester
Downes, William...Dedham, Colchester, Essex
Downes, Wm. Henry...New House, Much Wenlock, Salop
Downing, John Cole ..The Hill, Earl Soham, Woodbridge, Suffolk
Downs, John Henry...Grays, Essex
Dowson, Henry G....Geldeston, Norfolk
Dowson, B....Quay, Yarmouth
Downward, Rev. Geo. Rich....Shrewsbury, Shrops.
Doyne, Robert...Wells, county Wexford, Ireland
Drage, Thomas...Haddenham, Ely

Drake, F. W. T.... Hitchen Hill, Hitchen, Herts
Drake, George... Manor Farm, E. Tytherley, Stockbridge, Hants.
Drake, Sir T. Trayton F. Elliot, Bart.... Nutwell Court, near Exeter, Devonshire
Drake, T. T.... Shardloes, Amersham, Bucks.
†Drax, J. S. W. Erle, M.P.... Charborough Park, Blandford, Dorsetshire
Dray, William... 46, King William Street, City
Drew, John... Peamore Cottage, near Exeter, Devon.
Drew, John, jun..... Powderham, near Exeter
Drew, P.... Glanhassen, Newtown, Montgomerysh.
†Drewe, E. S.... The Grange, Honiton, Devonshire
†Drewitt, George... Manor Farm, Oving, Chichester
Drewitt, John... North Stoke, Arundel, Sussex
†Drewitt, R. Dawtrey... Burpham, Arundel, Sussex
Drewitt, Thomas, jun.... Guildford, Surrey
Drewry, George... Holker House, Cartmell, Lancas.
Driver, Edward... 8, Richmond Terrace
†Driver, George Neale... 8, Richmond Terrace
Druce, Joseph... Ensham, near Oxford
Druce, Samuel... Ensham, near Oxford
†Druce, Samuel, jun.... Ensham, near Oxford
†Drummond, Andrew Robt... Cadland, New Forest, Southampton, Hants.
Drummond, Dr. Henry... 103, Gloucester Place, Portman Square
†Drummond, Hon. W. H.... Castle Strath Allan, Auchterarder, N. B.
Drury, George V.... Eastbourne, Sussex
Drury, Thomas... Shawbury, near Shrewsbury
Du Cane, Capt. Chas.... Braxted Lodge, Kelvedon, Essex
†Duckworth, Sir John, Bart.... Wear House, near Exeter, Devonshire
Duffield, James... Great Baddow, Chelmsford
Dugdale, John... Manchester
Duke, Charles... East Lavant, Chichester, Sussex
Duke, Henry... Earnley, Chichester, Sussex
Dumolo, John... Dunton House, Fazeley, Staffordshire
Dunbar, Hon. Robert... Latheronwheel, Dunbeath, Caithness
Duncalfe, R... Honington Grange, Newport, Shrops.
Duncan, William George.... Great Houghton House, near Northampton
†Duncombe, Hon. Octavius M.P.... 24, Arlington Street
Duncuft, John, M.P.... Westwood House, Oldham
Dunn, Geo.... Ellingham, Alnwick, Northumberld.
Dunn, Richard... Ryden Farm, Evesham, Worcest.
Dunn, Thomas... Richmond Hill, near Sheffield
†Dunne, Thos., jun.... Bircher, Leominster
Dunning, Ralph ... Bishop's Burton, Beverley, Yorkshire
Dunning, William, jun.... Friar Waddon, near Dorchester, Dorsetshire
Duppa, Thos. Duppa... Longville, Church Stretton, Shrewsbury, Shropshire
Du Pré, Caledon George, M.P. ... Wilton Park, Deaconsfield, Bucks.
Dyer, George... 3, Pollington Villas, Holloway, Middlesex
Dyke, Henry... Parade, Monmouth
Dyke, J. D.... Glovers, near Sittingbourne, Kent
Dyke, Sir Percival Hart... Lullington Castle, Dartford, Kent
Dyke, Rev. Thomas Hart... Long Newton, Stockton-on-Tees
Dymock, Rev. Edward... Penley Hall, near Ellesmere, Salop
Dymoke, Sir Henry, Bt.... Scrivelsby Court, Horncastle, Lincolnshire
Dyott, Capt.... Freeford, Lichfield, Staffordshire
Dyson, Thos... Manor House, Braithwell, Rotherham

Eames, James.. Beck Farm, Beaulieu, Southampton
Eames, John... Ashby-de-la-Zouch, Leicestershire
Eardley, Sir Culling E.... Belvedere, Erith, Kent
†Earle, Richard... Knowsley, Prescot, Lancashire
Earle, Thomas... Itchen Stoke, near Alresford, Hampshire
East, Edwin... Streatham, Surrey
East, Sir East Clayton, Bart.... Hall Place, Maidenhead, Berkshire
†Easthope, Sir John, Bart.... Fir Grove, Weybridge, Surrey
Easton, Richard... Moortown Farm, Canford, near Wimborne, Dorset
†Easton, James... Nest House, Gateshead
Eastwood, Richd.... Townley Brimshaw, near Burnley, Lancashire
Eaton, George... Spixworth, Norwich, Norfolk
Ebbetts, John... Witchingham, Reepham, Norfolk
Eckley, Richard... 12, Darlington Place, Bath
†Eddison, Edwin... Headingly Hill, Leeds
†Eddison, Hy.... Gateford, Worksop, Notts.
Eddowes, John... Grimmer, Shrewsbury
Eden, John.... Beamish Park, Chester-le-Street, Durham
Eden, Robert... Hampton Court, Middlesex
Edgar, Rev. Mileson G.... Red House, Ipswich, Suffolk
Edgell, Richd. Wyatt.. Milton Place, Egham, Surrey
Edgington, Benjamin... 2, Duke Street, Southwark
Edmondson, John... Grassyard Hall, Lancaster
Edmunds, Edmund... Rugby
Edwardes, Hon. William.. Edmondthorpe, Oakham, Rutlandshire
Edwards, Frederick... Barnham, Thetford, Norfolk
Edwards, Henry... Winchester
Edwards, Sir John, Bart.... Greenfields, Machynlleth, N. W.
Edwards, John... Ness Strange, near Shrewsbury
Edwards, Joseph... Ross, Herefordshire
Edwards, O. H.... Chesterford, Essex
Edwards, Richard... Roby Hall, Prescot
Edwards, Samuel... Foxhall, Ross, Herefordshire
Edwards, Thomas... Hapton Hall, Long Stratton, Norfolk
Edwards, Thos. Downes... Hodgebatch, Bromyard
Edwards, William... Brook House, Ross, Herefords.
Egerton, Major-Gen. Richard... Eaton Banks, Tarporley, Cheshire
Egerton, Sir Philip de Malpas Grey, Bart., M.P.... Oulton Park, Middlewich, Cheshire

Egerton, Rev. Thomas....Middle Rectory, Shrewsbury
Eggar, Frederick...22, Whitehall Place
†Eland, Stephen Eaton...Manor House, Stanwick, Higham Ferrers, Northamptonshire
Eldin, Joseph...Cottam Grange, Sledmere, Yorks.
Eley, Charles..Beavere Farm, Hounslow, Middlesex
Elgar, James...Wingham, Kent
†Elkins, Joseph Norton...Elkington Welford, Northamptonshire
Elliot, John...Field House, Clifton, Bristol
†Elliot, John..Chapel Brampton, near Northampton
Elliot, Rev. T. Elphinstone....Whalton Rectory, Morpeth
Elliott, Eustace...Smeaton Pellaton, Landulph, near Devonport
Elliott, John...Chichester, Sussex
Elliott, William...Fawley, near Ross, Herefordshire
Ellis, Charles...Franklands, St. John's Common, Hurstperpoint, Sussex
Ellis, John...Beaumont Leys, near Leicester
Ellis, John...12, Clement's Lane, City
Ellis, Richard...Northampton
Ellis, Robt: Ridge .. Yalding, Kent.
Ellis, Thomas R. ...Oxnead Hall, Buxton, Norwich
†Ellis, William, LL.D....Caistor, Lincolnshire
Ellis, William...Ashford, Chertsey
Ellison, John...Sandbeck, Rotherham, Yorkshire
Ellison, J. ... Allerton Park, Green Hammerton, York
Ellison, Michael...Sheffield, Yorkshire
Ellison, W....Syzergh Castle, Kendal, Westmoreld.
Ellman, Rev. H. J....Carlton Rectory, near Bedford
Ellman, John...Landport, Lewes, Sussex
Ellman, R. H....Landport, Lewes, Sussex
Ellman, Thomas...Beddingham, Lewes, Sussex
Elton, Sir Edw. Marwood, Bart...Widworthy Court, Honiton, Devon
Elton, Major Robt. J....Whitestanton, Taunton, Somerset.
Elwes, H...Colesburne, Cheltenham, Gloucestersh.
†Elwes, Capt. Henry Cary...2, Aurora Place, Exmouth, Devon
Elwes, J. M. ...Bossington House, Stockbridge, Hampshire
Elwood, Lieut.-Col. Charles W....Clayton Priory, Hurstperpoint, Sussex
Embleton, Robert...Embleton, Alnwick
Emery, Charles...Burcot, Wellington, Shropshire
Emery, Richard...Huston Place, Storrington, Petworth, Sussex
Emlyn, Viscount, M.P....Stackpole Court, near Pembroke, S. Wales
Empson, Henry.... West Ravendale, Binbrook, Spital, Lincolnshire
Emson, H. H....Nether Hall, Cherry Hinton, Cambridge
England, Richard...Bingham, Wells, Norfolk
Enniskillen, Earl of..Florence Court, Fermanagh, Ireland
Ensor, John...Dorchester, Dorsetshire
Enys, John Samuel...Enys, near Penryn, Cornwall
†Erle, Rev. C....Hardwicke, Aylesbury, Bucks.
Errington, John...High Warden, Hexham, Northumberland
†Escott, Bickham...Hartrow, Taunton, Somerset.
Etches, J. Clifford...Hareby Thorn, near Stone, Staffordshire
Ethelstone, Rev. C. W....Up Lyme, Lyme Regis, Dorset.
Etheredge, Charles...Starston, Norfolk
Etheredge, Fred. Wm....Mill Hall, Maidstone
Etwall, William...Penton, Andover, Hampshire
Evans, C. H...Plasgwyn, near Beaumaris, Anglesey
Evans, H. R., jun....Ely, Cambridgeshire
Evans, Isaac P....Griff, Coventry, Warwickshire
Evans, Rich....Tyny Park, Cardiff, Glamorganshire
Evans, Robt....Foleshill Road, Coventry, Warwickshire
Evans, Robt., jun....West Hallam, near Derby
†Evans, R. W....Eyton Hall, Leominster
Evans, Samuel...Darly Abbey, near Derby
Evans, Capt. T. B...Deane House, Enstone, Oxon
Evans, Thomas William...Allestree, Derby
Evans, Wm..Glascoed, near Llansantffraid, Oswestry
Evans, William...Roath, near Cardiff, Glamorganshire, S. W.
†Evans, Rev. W. E....Burton Court, Herefordshire
Eve, William .... Manor Farm, North Ockendon, Romford, Essex
Everard, Edward...Middleton, Lynn, Norfolk
Everard, James Elsden...Congham, Castle Rising, Norfolk
†Everett, William, Chase Side House, Enfield
Everett, Isaac...Capel St. Mary, Ipswich, Suffolk
Everitt, Isaac...Pottergate Street, Norwich
Everitt, James...North Creake, Fakenham, Norfolk
Evershed, John...Albury, Guildford, Surrey
Ewen, Thos. L'Estrange...Dedham, near Colchester, Essex
Ewings, William...213, High Holborn
Exall, Wm....Kate's Grove Iron Works, Reading, Berkshire
Exley, William H....Wisbeach, Cambridgeshire
Exton, John...Eastwell, Melton Mowbray, Leicestershire
†Eyre, Geo. Edw....Warrens, Stony-Cross, Southampton, Hampshire
Eyre, Robert...Bartley Totton Wear, Southampton
Eyston, Charles...Hendred, Wantage, Berkshire
Eyton, John Wynne...Lee's Wood, Mold, Flintshire
†Eyton, Thos. C...Donnerville, Wellington, Shrops.
Eyton, Thomas W....Brook Park, Northop, Flint.
Eyton, William.. Condover, near Shrewsbury

Fair, James...Warton Lodge, Lytham, near Preston, Lancashire
Fair, Thomas...Frenchfield, Penrith, Cumberland
Fairhead, W. F....Totham, Maldon, Essex
Faithful, Rev. Geo. D....Lower Heyford, Woodstock, Oxon
Falcon, Thomas...Workington, Cumberland
Falkner, Edward Dean...Fairfield, near Liverpool
Fane, Cecil...4, Upper Brook Street
Fane, John...Wormsley, Watlington, Oxon
Fardell, Rev. Henry...Wisbeach, Cambridgeshire

†Fardon, Henry Fowler...The Firs, Bromsgrove, Worcestershire
†Farhall, John N....Tillington, near Petworth, Sussex
Farhall, Richard...Billingshurst, Sussex
Farley, George...Henwick, near Worcester
Farmer, Edw....Fazeley, Staffordshire
Farmer, Henry Grimes....Haven Farm, Tickhill, Bawtry
Farmer, Rd....Sheldon, Birmingham, Warwickshire
Farncombe, Geo....Bishopstone, Lewes, Sussex
Farnham, E. B., M.P....Quorndon House, Loughborough, Leicestershire
Farquharson, Hen. J...Langton, Blandford, Dorset.
†Farr, Wm. W....Iford, Christchurch, Hampshire
Farrell, Richard...35, North George Street, Dublin
†Farrer, Edmund...Sporle, Swaffham, Norfolk
Farrer, James...Ingleborough, Settle, Yorkshire
Farrer, Rev. Richard..Ashley, Rockingham, Northamptonshire
Farrington, J. Nowell...Worden Hall, Chorley Lancashire
Faulkes, Robert...Beckingham, Newark, Notts.
Faulkner, Chris F. A...Bury Barnes, near Burford, Oxon
Faux, Edward...Yaxley Hill, Stilton
Faviell, W. Fred....Bakeham House, Egham
Fawcett, Rev. Chris...Boscombe Rectory, Salisbury, Wilts
Fawcett, John...Durham
Fawkes, F. Hawkesworth...Farnley Hall, Otley, Yorkshire
†Fearnhead, P...17, Clifford's Inn, Fleet Street
Fearnley, Fairfax...Bishopsfield, Bawtry, Notts
Featherstonhaugh, Walker...Hermitage, Chester-le-Street
Feilden, Joseph..Wilton House, Blackburn, Lancash.
Fell, William...The Close, Lichfield, Staffordshire
†Fellowes, Jas....29, Gloucester Place, Portman Square
Fellowes, J. Newton...Eggesford, Chumleigh, Devonshire
Fellowes, Hon. N....Eggesford, Chumleigh, Devon
†Fellowes, Richd....Englefield House, Reading
Fellowes, Rev. Thos...Beighton Rectory, Norwich
Fellowes, Thos. Abdy...Chippenham
Fellows, Wm. Manning...Ormesby, Great Yarmouth
†Felton, Clement...Dunton, Fakenham
Fenn, George... Beccles
Fenn, J. G....Ardleigh Rookery, Colchester, Essex
Fenton, Kirkby...Caldecote Hall, Nuneaton, Warwickshire
Fenwick, Andrew Robert....Netherton, Morpeth, Northumberland
Fenwick, J. Manners...Gallow-hill House, Morpeth
Fergusson, Archibald...Dunfallundy, Pitlochry, Perthshire
Fernandez Edward...Hatton Parsonage, Warwick
Fernie, George...Fron, near Oswestry
Ferrabee, John...Phœnix Iron Works, Stroud, Gloucestershire
Ferrers, Earl...Chartley Castle, near Lichfield, Staffordshire
†Ferris, Thos...Manningford Bohune, Pewsey, Wilts
†Ferris, William...Draycot, Pewsey, Wiltshire
Festing, Richd. Grindall...35, Green Park, Bath, Somersetshire
Fetherstonhaugh, Timothy...The College, Kirkswald, Penrith, Cumberland
Ffrance, R. Wilson...Rawcliffe Hall, Garstang
Ffrance, T. R. Wilson...Rawcliffe Hall, Garstang
Field, James Pope...Tring, Herts
Field, Jonathan...Laceby, near Limber, Lincolnsh.
Field, William David...Ulceby Grange, Barrow-on Humber, Lincolnshire
Fielden, Samuel...Centre Vale, Todmorden, Lancashire
Fielding, Jas...Denbigh House, Haslemere, Surrey
Fieldsend, Charles, jun....Kirmond, Binbrook, Lincolnshire
Fifield, Job...Hill Park, near Romsey, Hants
Filder, James Moses...The Pages, Bexhill, Sussex
Filliter, Geo...Trigon Hill, Wareham, Dorsetshire
Finch, Henry...69, King William Street, City
Finch, Hon. Col. John, C. B....The Castle, Berkhampstead
†Finch, Rev. W...Warboys, Huntingdonshire
Finden, Geo. Fred...254, High Street, Borough
Firth, John, jun...Wentworth, Rotherham, Yorksh.
Fisher, George...Cambridge Bank, Cambridge
Fisher, Rev. R. W...Hill Top, Kendal, Westmld.
Fison, Cornell...Thetford, Norfolk
Fison, Thomas...Barmingham, Ixworth
†Fitzgerald, H. T. G...St. Mary's Vicarage, Reading, Berkshire
Fitzgerald, William Seymour...Hollbrook, Horsham
Fitz-Herbert, Sir Henry, Bart...Tissington Hall, near Ashbourne, Derbyshire
Fitz-Herbert, William...Somersal Herbert, Uttoxeter, Staffordshire
Fitz-Hugh, Thomas...Plas-Power, near Wrexham, Denbighshire
Fitz-Hugh, Rev. W...Street, near Lewes, Sussex
Fitz-Patrick, Right Hon. J. Wilson, M.P...Lesduff, Rathdowny, Queen's County, Ireland
Fitz-Patrick, Richard Nelson...Granstown Manor, Queen's County, Ireland
Fitzroy, Geo...Grafton-Regis, Stony Stratford, Bucks.
Fitzroy, Lieut.-Col. Hugh...Sennowe Lodge, Guiest, Norfolk
Flack, William...Water's Place, Ware, Herts.
Flesher, Rev. J. T....Tiffield, Towcester, Northamptonshire
†Fletcher, Major E. C....Ulcombe Place, Maidstone, Kent
†Fletcher, Sir Henry, Bart...Ashley Park, Walton-on-Thames, Surrey
Fletcher, Jno...Knipton, Melton Mowbray, Leicests.
†Fletcher, John Philip...Ashley Park, Walton-on-Thames, Surrey
Fletcher, Josiah...Norwich
Fletcher, W....Radmanthwaite, near Mansfield, Notts.
Flint, John...Leighton Buzzard, Bedfordshire
Flowerdew, J. S. ... Hinderclay, near Botesdale, Norfolk

Floyd, Cookson Stephenson...Holmforth, Huddersfield
Floyd, Thomas...Frilford, Abingdon, Berkshire
†Floyer, John...Stafford, Dorchester, Dorsetshire
Floyer, John...Hints, Tamworth, Staffordshire
Floyer, Jno. W....Caukwell, near Horncastle, Linc.
†Foljambe, Geo. Savile...Osberton House, Worksop
Folkes, Sir Wm. Browne, Bart....Hillington Hall, near Lynn, Norfolk
Folkestone, Viscount...Longford Castle, Salisbury, Wiltshire
Fookes, Henry, jun....Monkton, Blandford, Dorset
Footner, W. A....Romsey, Hampshire
Forbes, Sir J. S., Bart....Pitsligo, Fettercairn, N. B.
Ford, A. R....Ellel Hall, near Lancaster
Ford, John, jun....Preston Farm, Blandford, Dorset
Ford, Richard S....Clifford's Wood, Stone, Staffs.
Fordham, J. E....Melbourn Bury, Royston, Herts.
Fordham, John George...Royston, Herts.
Forester, G. T....Ercall Magna, Wellington, Shrops.
Forester, Rev. R. T. ..High Ercall, Wellington, Salop
Forrest, John...Stretton, near Warrington, Lancs.
Forrester, George...Bryanston, Blandford, Dorset
Forrester, John...Stanmore Priory, Middlesex
Forster, John...18, Carey Street, Lincoln's Inn
Forster, Richard Carnaby...Whitehouse, Gateshead, Durham
Forster, Robert...Tottenham Green, Middlesex
†Forster, Samuel...Southend, Sydenham, Kent
Forster, Wm...Burradon, near Rothbury, Northumb.
Forsyth, Thomas...South Shields
Fort, George...Alderbury House, Salisbury, Wilts.
Fortescue, Hon. G....Boconnock, Lostwithiel, Cornwall
Fortescue, Rev. H. R....East Allington, Totnes
Fosbrooke, Leonard ... Ravenstone, Ashby-de-la-Zouch, Leicestershire
Foster, Aug...Warmwell House, Dorchester, Dorset.
Foster, John...Lingodell, Tickhill, Rotherham
Foster, Jno...Rumbridge Street, Eling, Southampton
†Foster, John James...The Scaws, Penrith
Foster, Joseph...Blunt's Hall, Witham, Essex
Foster, Richard...Castle, near Lostwithiel, Cornwall
Foster, Richard, jun....Cambridge
Foster, Robert Carr...4, Marine Parade, Worthing
Foster, William...Hanworth, Sleaford, Lincolnshire
Foster, Wm....Wordsley House, near Stourbridge, Worcestershire
Fothergill, Mark...Chalcot Villa, Haverstock Hill
Fothergill, Matthew...Cefmachder, Bedwelty, near Newport, Monmouthshire
Fothergill, Richard...Lowbridge House, Kendal
Fothergill, Richard...Tredegar, Abergavenny, Monmouthshire
Fothergill, Rowland...Hensol Castle, Cowbridge, Glamorganshire
Foulkes, James Hassall...Chester
Foulkes, John...Penyboyn, Newtown, Montgomeryshire
†Foulkes, John Jocelyn...Eriviatt, Denbigh
Fountaine, Bernard ... Stoke Hammond House, Leighton Buzzard, Bedfordshire
Fouracre, T. W....Durston, near Taunton, Somerset.
Fowle, Wm....Market Lavington, Wilts.
Fowler, Geo. W....Prince Hall, Tavistock, Devon
Fowler, Henry...Kingham, Chipping Norton, Oxon
Fowler, John Kersley, jun....Aylesbury, Bucks.
Fowler, Marshall...Preston Hall, near Stockton-on-Tees, Durham
Fowler, Michæl...Little Bushy Farm, Stanmore, Middlesex
†Fowler, R. C....Gunton Hall, Lowestoft, Suffolk
Fowler, Rear-Admiral M....Walliscot House, Whitchurch, near Reading
Fowler, Rd. jun...Gravelly Hill House, Birmingham
Fowler, Thomas...Tottenham, Middlesex
Fowler, William Barrett...Freazley, Fazeley, Staffs.
Fowler, William M....59, Grosvenor Street
Fowlie, Wm....Red House, Hursley, Winchester, Hants
Fox, Baruch...Beaminster, Dorsetshire
Fox, Rev. Dr....Queen's College, Oxford
Fox, Frederick F....Melbourne, near Derby
Fox, George C....Grove Hill, Falmouth, Cornwall
Fox, Hy. Hawes, M.D....North Woods, near Bristol
Fox, Robert...153, Westbourne Terrace, Bayswater
Fox, William ... Elfordleigh, Plympton St. Mary, Devon
Foxwell, Thos. S....High Street, Shepton Mallet, Somersetshire
Frampton, Hy....Oakers Wood, Dorchester, Dorset.
Francis, Samuel...Ford Place, Stifford, near Romford, Essex
Francis, S. R. G....Scranham Place, North Ockendon, near Romford, Essex
Francis, William ... Packsfield House, Raynham, Fakenham
Franklin, Edw. L....Ascott, near Benson, Oxfordsh.
Franklin, Jno....Ewelme, near Benson, Oxfordshire
†Franklin, Richd....Clemenstone, Bridgend, S. W.
Franklin, Robt....The Park, Thaxtead, Essex
Franklyn, Thomas...Maidstone
Franks, George...Hunsdon, near Ware, Herts
Franks, James...Albury, Guildford, Surrey
Fraser, Alexander...Gatwick, Crawley, Sussex
Fraser, Alex....Middle Claydon, Winslow, Bucks.
Frederick, Sir Rich., Bart....Burwood Park, Walton-on-Thames, Surrey
†Freebody, W. Yates...9, Duke Street, Westminster
Freeman, John...East Rudham, Rougham, Norfolk
Freeman, Jno., jun...Summerfield, Docking, Norfolk
Freeman, John Gardner...Rockfield, near Hereford
Freeman, Joshua...Dersingham, Lynn
Freeman, W....Heigham Grove, Norwich
Freeman, W. Peere Williams...Fawley Court, Henley-on-Thames, Oxon.
Freestone, Thomas...Irthlingborough, Wellingboro.
Fremantle, Rt. Hon. Sir W. H...Englefield Green, Chertsey, Surrey
Fremantle, Rev. W. R....Rector of Middle Claydon, Winslow, Bucks.
†Frere, Geo. Edw....Roydon Hall, Diss, Norfolk
Frere, Ph. H. ... Downing College, Cambridge
Frogley, Ralph Allen...Hounslow, Middlesex
Fryer, Wm. R....Lytchett, Poole, Dorsetshire

Fulford, Baldwin...Great Fulford, Exeter
Fullagar, James...Milton, Sittingbourne, Kent
Fullard, Thomas....Thorney, near Peterborough, Northamptonshire
Fuller, Aug. E., M.P....Rose Hill, Robert's Bridge, Sussex
Fuller, Hugh...Portslade, Brighton, Sussex
Fullerton, Rev. Arthur....Thryberg Rectory, Rotherham
Fulljames, Thos....Hasfield Court, near Gloucester
Fulshaw, Richard...Knighton, near Leicester
Furniss, Lawrence...Birchill Farm, Bakewell, Derbyshire
Fussell, Rev. G. C....Chantry, Frome
Fust, Right Hon. Sir Herbert Jenner...Chislehurst

Gabell, Chas...Hollyfield, near Crickhowell, Brecknockshire
Gage, Hon. William...Westbury House, Petersfield, Hants
Gale, Edward M....Upham, near Bishop's Waltham, Hants
Gale, Richard Christopher...Winchester, Hants
Gale, Wm. Hy....Grately, near Andover, Hants
Gale, Rev. W. W....Pylle Rectory, Shepton Mallet, Somersetshire
Gall, John...New Buckenham, Norfolk
Galpin, John...Dorchester, Dorset.
†Galton, Darwin..Edstone Hall, Stratford-on-Avon, Warwickshire
Galton, Erasmus...Loxton Manor House, near Cross, Somersetshire
†Galway, Viscount, M.P....Serlby Hall, Bawtry
Gambier, Chas. S....19, Upper Harley Street, Cavendish Square
Gamble, John...Manor Farm, Shouldham, Thorpe, Norfolk
Gamble, J. C....Sutton House, St. Helen's, Lancash.
Game, John....Pointington, near Sherborne, Dorset.
Gamlen, Wm. H....Hayne House, Tiverton, Devon.
†Gandy, James..Heaves, near Kendal, Westmorld.
Gape, Thos. Foreman...St. Albans, Hertfordshire
Garbitt, Richard...Lawley, Wellington, Salop
Gardener, Jas....Oxford Arms, Kington, Herefordsh.
Gardiner, George...Horsford, Norwich, Norfolk
Gardner, Robert...Leighton Hall, near Shrewsbury
Gardner, Wm. Nettleton...Wells, Norfolk
Gardner, Wm. Wells...Biggleswade, Bedfordshire
†Gardom, Thomas...The Yeld, Baslow, Bakewell
Garland, Captain Joseph G., R.N. ... Stoneleigh, Wimborne, Dorsetshire
Garmston, John...Worcester
Garne, Wm....Aldsworth, Northleach, Gloucestersh.
†Garnett, Robert...Wyreside, Lancaster
Garnett, Wm....Quernmore Park, near Lancaster
Garnett, Wm. Jas. ... Bleasdale Tower, Garstang, Lancashire
Garrard, Chas. B. D...Lama Hall, St. Albans, Herts.
Garrard, James...Pinner Place, Watford, Herts.
Garratt, Francis...Ellacombe, near Torquay, Devon.
†Garratt, John, jun...Farringdon House, nr. Exeter
Garrett, John...Ickleton, Saffron Walden, Essex
Garrett, Rich., jun....Leiston, Saxmundham, Suffolk
Garrod, James...Wells, Somersetshire
Garsed, John...Llanwitt, near Cowbridge, Glamorganshire
Garth, Rev. Richard...Farnham, Surrey
Garth, Thomas C....Haines Hill, Reading, Berks.
Gascoyen, George...Stanwick, Higham Ferrers
Gascoyen, George...Birchmore, near Woburn, Beds.
Gaskell, W. P....Rolfes Hould, West Wycombe, Buckinghamshire
†Gatacre, Edward L....Coton, near Kidderminster, Worcestershire
Gataker, George...Mildenhall, Suffolk
Gater, C. H...Swathling, near Southampton, Hants
Gates, John A....Grange Farm, Sapistone, Ixworth
†Gates, Richard...Marshall Vale, Bramley, Guildford, Surrey
Gatrell, Wm. Verling...Lymington, Hampshire
Gaudern, John...Earl's Barton, Wellingborough, Northamptonshire
Gaussen, Robt. Wm....Brookman's Park, Hatfield, Hertfordshire
Gawler, Henry...Ramridge Cottage, Andover, Hants
†Gawne, Edward M....Kentraugh, Isle of Man
Gay, James...Thurning Hall, Norfolk
Gayford, Geo....Rymer House, Thetford, Norfolk
Gayner, John...Filton, near Bristol
Gearey, James...Gt. Westwood, Watford, Herts.
†Geary, Sir Wm. R. P., Bart....Oxen Heath, Tunbridge, Kent
Gedge, Johnson...Bury St. Edmund's, Suffolk
Gee, Thomas...Brothertoft, Boston
Geldard, George A....Aikrigend, Kendal, Westmoreland
Geldard, John...South Benwell House, Newcastle-upon-Tyne
George, James...Cotham, Bristol
George, James Gilbert...Monmouth
Gerrish, Thomas...Upton, near Andover, Hants
Gervais, Rev. Francis...3, Grafton Street, Dublin
Gibb, John...Coollatin Park, Wicklow, Ireland
Gibbon, Alexander...Staunton, near Coleford, Gloucestershire
Gibbons, Edward...Minster, Isle of Thanet, Kent
Gibbons, Stephen...Brocklesby, Great Limber
Gibbons, Thomas...Wolverhampton, Staffordshire
Gibbs, Chas...Bishop's Lydeard, Taunton, Somersetshire
Gibbs, Geo....26, Down Street, Piccadilly
†Gibbs, Geo....Belmont, near Bristol
Gibbs, Joseph...Elsfield, near Oxford
Gibbs, Wm....Tyntesfield, Bourton, near Bristol
Gibbs, Wm....Itchenor House, Chichester, Sussex
Gibbs, William, jun....Alveston Hill, Stratford-on-Avon, Warwickshire
Gibson, George...Kendal, Westmoreland
Gibson, Geo. John...Sandgate Lodge, Storrington, Steyning
Gibson, John...Leazes Terrace, Newcastle-on-Tyne
Gibson, Richard...Swarkeston Lowes, near Derby
Gibson, William...Kirkby Green, near Lincoln
Gidney, Jeremiah W....East Dereham, Norfolk
Giffard, Rev. Jas., M.A....Vicar of Wootton, near Barrow-on-Humber, Lincolnshire

Gilbert, Henry...Castle Gate, Newark, Notts.
Gilbert, James...120, Bordesley Street, Birmingham
†Gilbert, Robert...Ashby Hall, Berghapton, Norfolk
Gilbert, Wm.. .Chute, Hippenscombe, near Andover, Hants
†Gilbert, Wm. A. ...Cantley, Acle, Norfolk
Gilbertson, M....Elm Cottage, Egham Hill, Surrey
Gill, George...Weston, Shrewsbury, Shropshire
Gill, Wm....Billingford, Dereham
Gillespie, Robert...33, York Place, Portman Square
Gillett, John...Brailes, Shipston-on-Stour, Warwickshire
Gillett, John...Tunstall, Acle, Norfolk
Gillett, Joseph Ashby...Banbury, Oxfordshire
Gillett, Richard...Plumstead, Norwich
Gillett, William...Southleigh, Witney, Oxfordshire
Gilling, Thos....Wells, Somerset
Gilpin, George...Sedbury Park, Richmond, Yorkshire
Gilpin, Lieut.-Col. Richard ... Hockliffe Grange, Leighton Buzzard, Bedfordshire
Gilstrap, J....Hawton, Newark, Nottinghamshire
Ginders, Samuel...Ingestre, near Stafford
Girdlestone, Rev. H.... Landford, Salisbury, Wilts.
Girdlestone, Robert...Kellinghall, Holt, Norfolk
Girdwood, John...Chirk, N. W.
Girling, John...Earlham, Norwich
†Gisborne, Matthew...Walton Hall, Burton on-Trent, Staffordshire
Gleaves, Wm....Abbotsley, St. Neot's, Huntingdonshire
†Glegg, Baskerville..Backford, Chester, Cheshire
Glegg, Jno. Baskeroyle...Withington House, Chelford, Knutsford, Cheshire
Glencross, William...Luxstowe, Liskeard, Cornwall
†Glendining, A....Ash Grove, Seven Oaks, Kent
Glover, John...Bangley, Tamworth, Staffordshire
Glover, Wm....12, Northumberland Street, Newcastle-upon-Tyne
Glynne, Rev. Henry...Hawarden Rectory, Chester
Glynne, Sir Steph. Bart., M.P....Hawarden Castle, Flintshire
†Gobbett, John...Iken Hall, Saxmundham, Suffolk
Goddard, Ambrose...The Lawn, Swindon, Wilts.
Goddard, Horatio Nelson...Cliffe, Wootton Bassett, Wiltshire
Goddard, Thos...St. Fagons, Cardiff
Goddard, William Gilbert....Berwick St. John, Salisbury
Godfrey, George...Childrey, Wantage, Berkshire
Godsell, Thos....The Bower, Holme Lacy, near Hereford
Godwin, Shadrack...Grove Hill, Hemel Hempstead
Godwin, William...Bossington, Stockbridge, Hants.
†Goldhawk, Rowland, jun....Hasle Hall, Steer, Guildford, Surrey
Golding, Wm., jun...Leavers, East Peckham, Kent
Goldsmith, John...North Farm, Crostwich, Norwich
Goldsmith, Thomas...Dairy Farm, Ixworth
Goldsmith, William...30, Parliament Street
Gomme, John...St. Julians, near St. Albans, Herts.
†Gooch, Edward Sherlock, M.P...Ashmans, Beccles
Gooch, John Kerr...East Tuttenham, Norwich
Gooch, Stephen...Honingham, near Norwich
Goodacre, R...Ullesthorpe, Lutterworth, Leicesters.
Goodall, Michael...Evelith Manor, Shiffnal, Salop
†Goodden, J....Over Compton, Sherborne, Dorset
Goode, Edw.... Aston Court, Tenbury, Worcesters.
Goode, George.. Croft Cottage, Carmarthen
Goode, Hy. Philps....Scotchwell, Haverfordwest, Pembrokeshire
Goodenough, Joseph ... Godmanstone, Dorchester, Dorsetshire
†Goodlake, T. Mills...Wadley House, Faringdon, Berkshire
Goodman, Timothy ..Warminster, Wiltshire
Goodricke, Sir Fras. L. H., Bart....Clermont Lodge, Watton, Norfolk
Goodwin, Capt. Fras. Green ... Wigwell Grange, Wirksworth
Goodwin, George...Langar, near Bingham, Notts.
Goodwin, Wm...Birchwood, near Alfreton, Derbys.
Goodwyn, S. C...Huntingfield Hall, Yoxford, Suff.
Gordon, Alexander...Eudon, Bridgenorth, Salop
Gordon, Charles...Heavitree, near Exeter, Devon
Gordon, Jas. Adam...Naish, near Bristol, Somerset.
Gordon, Rev. Lord George... Chesterton, Stilton, Huntingdonshire
Gordon, Robt...Kemble House, near Cirencester, Gloucestershire
Gorham, John...West Wittering, Chichester, Sussex
Goring, Chas...Wiston Park, Steyning, Sussex
†Goring, Sir H. D., Bart....Highden, Shoreham, Sussex
Goring, Mrs. M....Wiston Park, Steyning, Sussex
Gorringe, James...Selmiston, Lewes, Sussex
Gorringe, J. P...Eastbourne, Sussex
Gosford, Wm...Everingham, Pocklington, near York
Gosling, Bennett...Roehampton Grove, Surrey
Gosling, John ..Bocking, Essex
Gosling, Robert...Hassobury, Bishop's Stortford
Gosling, Thos....10, Chandos Street, Cavendish Sq.
†Gosset, Capt. Arthur...Eltham, Kent
Gotch, T. H...Kettering
Gough, Edward...Gravel Hill, Shrewsbury, Salop
Gough, Ralph...Gorsebrook, Wolverhampton
Gough, R. D.... Yniscedwin, near Neath, Glamorg.
Gould, John... Poltimore, Exeter, Devon
Gowan, George...20, Park Crescent
†Gower, Abel L...Castle Malgwyn, Llechryd, Newcastle Emlyn, Pembrokeshire
Gower, A. W...Hook, near Hartford Bridge, Hants.
Gower, George...Dilham, near Smallburgh, Norfolk
†Gower, J. Leveson...Gonver, Alverstoke, Gosport
†Gower, Robt. Fred...Glandovan, Pembrokeshire
†Gower, W. Leveson, jun...Titsey Place, Godstone, Surrey
Gowing, George...Trowse, Norwich
Graburn, R. S....Butleigh, Glastonbury
Graburn, William...Barton-on-Humber, Lincs.
Grace, Edward... Wallsend, Newcastle-on-Tyne
Grace, Edward Nath. ...Byker Hill, Newcastle-on-Tyne
Grace, H....Gates Ewhurst, near Northiam, Sussex
Grace, Jas...Wardrobes, Princes Risborough, Bucks.

Grace, Wm....Saltwick, Morpeth, Northumberland
Graddon, Wm....Bratton House, Chittlehampton Devonshire
†Græme, Major Geo. D....Inchbrakie House, Crieff, Perthshire
Graham, Carolus J. H....Strawan, Crieff, Perthshire
†Graham, James...Berstead Lodge, Bognor, Sussex
Grain, Peter...Shelford, near Cambridge
Grain, Peter, jun....Shelford, near Cambridge
Grainger, Richard...Newcastle-on-Tyne
Granger, John...Stretham, Ely, Cambridgeshire
Granger, Joseph...Stretham, Ely, Cambridgeshire
Granger, Thos. W...Stretham Grange, Ely, Camb.
Grant, H. J...The Gnoll Castle, Neath, Glamorg.
Grant, John...Manningford Bruce, Pewsey, Wilts.
Grant, Jonathan...East Coulston, Westbury, Wilts.
Grant, Joseph Cooke...Stamford, Lincolnshire
Grant, Wm...Litchborough, Towcester, Northamp.
Grantham, George...Barcombe Place, Lewes
Grantham, Stephen...Ryder's Wells House, Lewes, Sussex
Grantham, Rev. Thos...Bramber, Steyning, Sussex
Granville, Bernard ... Wellesbourne, Stratford-on-Avon, Warwickshire
†Granville, Earl...Aldenham, Bridgnorth
†Gratwick, W. G. K...Ham, Arundel, Sussex
Graves, Robt....Charlton, Shaftesbury, Dorsetshire
Gray, Alex. Geo...Newcastle-on-Tyne
Gray, Edw...Leazes Hill, Burnop Field, Gateshead
Gray, Russell...Barcombe, near Lewes, Sussex
Gray, William...East Bolton, Alnwick
Grazebrook, George...Stourbridge, Worcestershire
Greaves, James...Radclive, near Buckingham
Greaves, William...Matlock-Bath, Derbyshire
Green, Daniel...Fingringhoe, Colchester
Green, Francis...Court Henry, near Llandilo, Carmarthenshire
Green, Rev. Geo. Wade...Court Henry, Llandilo, Carmarthenshire
Green, James...Wroxham, Norwich
Green, James...Prescot, Lancashire
Green, Joseph B....Marlow, Ludlow
Green, Rich...Deepdene, Bury St. Edmund's, Suffolk
Green, Rich....Metheringham, nr. Sleaford, Lincs.
Green, Robt....Odstone Hill, Measham, Ashby-de-la-Zouch, Leicestershire
Green, Thomas...Trench Hill, Gateshead
Green, Rev. Thos. ..Vicar of Badby, Daventry
Green, Wm. Geo...Belford Villa, Belford, Northumb.
†Greenall, Gilbert, M.P...Walton Hall, Warrington, Lancas.
†Greenall, John...The Bank, Warrington, Lancas.
Greene, J., M.P....Greenville, co. Kilkenny, Ireland
†Greene, T., M.P....Whittington Hall, Lancaster
Greene, Capt. W. Burnaby...Wickham, Hants.
Greenfield, James...Brynderiven, Usk, Monmouth.
Greenham, Jas....Blankney Fen, Lincoln
Greenhow, John...Kendal, Westmoreland
Greenway, Henry...Hambrook, near Bristol
Greenwood, Chas....Wallingford, Berkshire
†Greenwood, Edwin...Swarcliffe, Harrowgate
†Greenwood, Fred....Ryshworth Hall, Bingley
Greetham, Thomas...Stainfield Hall, Lincoln
Greg, Thos....Ballymenock, Hollywood, co. Down
Gregg, James ..Ledbury
†Gregg, Thomas...
†Gregor, Gordon H. F....Trewarthewick, Tregony, Truro, Cornwall
†Gregson, Mathew...Toxteth Park, Liverpool
Grenfell, C. P., M.P....38, Belgrave Square
Grenfell, Riversdale...Ray Cottage, Maidenhead
Grenville, Hon. and Rev. G. N., Dean of Windsor..Butleigh Court, Glastonbury
Greville, Algernon...North Lodge, Potters' Bar, Barnet
Greville, Fulke S..North Mims Park, Hatfield, Herts.
Grey, Hon. B. N. Osborn De...Fawley, Southampton
†Grey, Capt. Chas. Bacon...Styford, near Hexham, Northumberland
Grey, Hon. and Rev. F. De..Copdock Rectory, Ipswich
†Grey, Capt. Hon. F. W., R.N...Howick, Alnwick
†Grey, Right Hon. Sir George, Bart., M.P....Fallowdon, near Alnwick, Northumberland
Grey, G. A....Milfield Hill, Wooller, Northumb.
Grey, Hon. G. De..Rokeley, nr. Watton, Norfolk
Grey, Jas...Kimmerston, near Wooller, Northumb.
Grey, John...Dilston House, Newcastle-on-Tyne
Grey, Thos. R....Norton, near Stockton-on-Tees
Griffin, John...Borough Fenn, Peterborough, Northampton
Griffin, Richard...Coleshill, Amersham, Bucks.
Griffin, Wm. Ervin...Werrington, Peterborough, Northamptonshire
Griffinhoofe, Rev. T. S...Arkesden, near Bishop's Stortford, Hertfordshire
Griffith, C. D...Padworth House, Reading, Berks
Griffith, E. H...Ty-Newydd, near Denbigh
Griffith, J..Llwynduris, Newcastle-Emlyn, Carmarthenshire
Griffith, Samuel Y...Queen's, Cheltenham
Griffithes, Thomas J...Bishop's Castle, Salop
Griffiths, Edward...New Court, near Hereford
Griffiths, Henry...Bryndafydd, near Swansea
Griggs, Money...Creake, Fakenham
Grime, Thomas...Ticknall, Derbyshire
Grimmer, Fred...Thurlton Hall, Loddon, Norfolk
Grimmer, H. S...Haddiscoe, Norfolk
Groom, Rich...3, Henrietta Street, Cavendish Squ.
Grose, Nich. M...Wadebridge, Cornwall
Grove, Dr...Fern, Shaftesbury
Grutt, Collings de Jersey...Sark, Guernsey
Guilford, Thomas...Nottingham
Guillonneau, Jacob...Twickenham
Gundry, Joseph...Bridport, Dorset
Gunner, William...Will Hall, Alton, Hampshire
†Gurdon, Brampton...Grundisburgh Hall, Woodbridge, Suffolk
†Gurdon, John Barrett...Assington Hall, Boxford, Suffolk
†Gurdon, Rev. Philip...Cramworth Rectory, Shipdham, Norfolk
†Gurdon, R. J...Wivenhoe Park, Colchester
†Gurdon, Wm....11, Crown-office Row, Temple
Gurney, Charles...Launceston, Cornwall
Gurney, John...Earlham, Norwich, Norfolk

†Gurney, John Henry...Easton, Norwich
Gurney, R. H...Hethersett, Thickthorn, near Norwich, Norfolk
Gwatkin, John...Parc-Behan, Tregony, near Truro, Cornwall
Gwilt, Rev. Dan..Icklingham Rectory, Mildenhall, Suffolk
Gwyn, H., M.P....Baglon House, Neath, Glamorganshire
Gwyn, R. H...Astbury Hall, Bridgnorth, Shropsh.
Gwynne, Capt. A. L...Monachty, Cardiganshire
Gyles, John...Aplayhead, East Retford, Notts.

Hack, James...Torquay, Devonshire
Hacker, John Heathcote...Leek, Staffordshire
Haggard, Wm. M. R...Bradenham Hall, Shipdham, Norfolk
Haggitt, Henry...Bury St. Edmunds
Hague, John...Coursehourne, Cranbrook, Kent
Haigh, Geo...Erdington, Birmingham
Haines, Edw....Moor Wood House, Cirencester Gloucestershire
Halcomb, Wm...Poulton, Marlborough, Wilts.
Halcomb, W. H...Chilton, Hungerford, Berkshire
Hales, Baseley...Salehouse, Blofield, Norwich
Hales, Rev. Robt...Hillington, Castle Rising, Norf.
†Halford, Rev. Thos..Downing College, Cambridge
Halford, Wm...Broughton Astley, Lutterworth
Halke, Rev. J...Weston-by-Welland, Northampton
Halket, Geo....Wainskeel, Bridgend, Glamorgansh.
Hall, Benj....Hanley Castle, Upton-on-Severn
Hall, Benj. E....Cilgwyn, Cardiganshire
Hall, Col., M.P. (1st Life Guards)
Hall, Edward Lloyd C....Emlyn Cottage, Newcastle Emlyn, Carmarthenshire
Hall, Francis...Park Hall, Mansfield, Notts.
Hall, George...Ely, Cambridgeshire
Hall, George...Barton Seagrave, Kettering
†Hall, Henry...Fritwell Manor House, Brackley Agho, Oxon
†Hall, Henry...Neasdon, Willesden, Middlesex
Hall, James...Scorborough, Beverley, Yorkshire
Hall, J. W. R....Springfield, near Ross, Herefordsh.
†Hall, John...Wiseton, near Bawtry, Notts.
Hall, J. O....1, Brunswick Row, Queen's Square, Bloomsbury
Hall, John...Arnold Lodge, near Nottingham
Hall, John...Kiveton Park, Sheffield, Yorkshire
Hall, Joseph...Callington, Bromyard, Herefordshire
Hall, Richard...Cirencester, Gloucestershire
Hall, Thomas...Hopton, Bakewell, Derbyshire
Hall, Thomas Kirkpatrick...Holly-bush, Burton-on-Trent, Staffordshire
†Hall, William...Ashton, near Leominster
Hallam, John...Newcastle, Staffordshire
Hallett, John James, M.D....Queen's Farm, Jersey
Halley, Francis...Shiffnal, Shropshire
Hallowes, Thos....Glasswell Hall, Chesterfield
†Halls, Joseph...Denham Hall, Bury St. Edmunds
Halsey, Rev. J. F. Moore...Gaddesden Park, Hemel Hempstead, Hertfordshire
Halsted, Thomas....Woodcote, near Chichester, Sussex
Halton, Rev. I....Winfield Manor, Alfreton, Derby
Halton, Rev. L. M. ... Woolhampton, Newbury, Berkshire
†Hambrough, Albert J...Steephill Castle, Newport, Isle of Wight
Hamersley, Hugh...Great Haseley, Tetsworth, Oxon
Hamerton, James...Hellifield Peel, Skipton
†Hamilton, Capt. Archd....Rozelle, near Ayr, N.B.
Hamilton, Edward...Bridgnorth
Hamilton, G. A., M.P....Hampton, near Balbrigan, Ireland
Hamilton, Geo. Ernest...Wolverhampton
†Hamilton, John...Sundrum, Ayr, N. B.
Hammond, Geo...Manor Farm, St. Mary Cray, Kent
Hammond, Horace John...Lewis Heath, Horsmonden, Cranbrook
Hammond, J.W...Wistaston Hall, Nantwich, Chesh.
Hammond, Thomas...Penshurst, near Tonbridge
†Hamond, W. Parker...Pampisford Hall, Cambridge
Hanbury, Edward....Hacheston, Wickham Market, Suffolk
Hanbury, Rev. G....Swaffham
Hanbury, John...Carborough, Lichfield, Staffordsh.
Hanbury, Robert...Poles, Ware, Herts
Hancock, Abraham ... Hall Place, Ropley, near Alresford, Hampshire
Hancock, J....Halse, near Milverton, Somersetshire
Hand, James...Ludlow, Shropshire
Hand, Rob...Woolsthorpe, Grantham, Lincolnshire
†Handley, Major Benjamin...Pointon House, Folkingham, Lincolnshire
Handy, Edward...Sevenhampton, near Andoversford, Gloucestershire
Hanford, C. E...Woolas Hall, near Pershore, Worc.
Hanham, Joseph Carey...Gunville, Blandford
Hankey, J. Barnard...Fetcham, Leatherhead, Surrey
Hanmer, Colonel...Bear Place, Maidenhead
Hanmer, Sir John, Bart., M.P....Bettisfield Park, Whitchurch, Salop
Hannam, Charles...Northbourne Court, Deal, Kent
Hannam, Henry J....Burcot, Benson, Oxon
Hannam, John..North Deighton, Wetherby, Yorksh.
Hannay, Rev. James..Ashley, Stockbridge, Hampsh.
Hanson, John...346, Strand
Harbin, George...Newton House, Yeovil, Somerset.
†Harcourt, G. G., M.P...Nuneham Park, nr. Oxford.
Harcourt, Capt. Octavius, R.N....Swinton Park, Bedale, Yorkshire
Hardcastle, J. A., M.P.... Coptfold Hall, Ingatestone
†Hardcastle, Jonathan..Blidsworth Dale, Mansfield, Notts.
Harding, Egerton William...Old Springs, Market Drayton, Shropshire
Harding, G....Fern Hill, Market Drayton, Salop
Harding, Geo...Durweston, Blandford, Dorsetshire
Harding, James...Waterson, Dorchester, Dorset.
Harding, J. C....Upton, Scudamore, Warminster
Harding, J. Goldie...Monkleigh, Torrington, Devon.
Harding, Richard...Warren Farm, Finmer, Bucks.
Harding, Stephen T....Stinsford Farm, near Dorchester, Dorset.
Harding, Wm. C...Lower Winchendon, Aylesbury, Bucks

Hardy, James...Jaques Hall, Manningtree
Hardy, Joseph...Midville, Boston, Lincolnshire
Hardy, Robert...Tendring Hall, Colchester, Essex
†Hardy, W. H. Cozens...Letheringsett Hall, Holt, Norfolk
Hare, Jabez...10, Nelson Square, Southwark
Hare, Joseph...Wilton Farm, Beaconsfield, Bucks
†Hare, Sir J....26, Royal Crescent, Bath
Hare, Sir Thomas, Bart...Stow Hall, Downham Market, Norfolk
Harewood, Earl of,...Harewood House, London
†Harford, John S....Blaize Castle, near Bristol
†Harford, W...Barley Wood, Wrington, near Bristol
Harkes, David...Mere, Knutsford
Harland, W. C... Sutton Hall, York
Harper, George...Belvidere, Whitchurch, Salop
Harper, John...Isham, Kettering, Northamptonsh.
Harper, John...Madley Manor, Newcastle-under-Lyne, Staffordshire
Harries, Francis, jun....Cruckton Hall, Shrewsbury
Harries, Gilbert J....Llanwnwes, Haverfordwest, Pembrokeshire
Harris, James...Plumstead Common, Kent
Harris, James...Long Sutton, near Odiham, Hants
Harris, John...Hinton, Abingdon, Berks
Harris, John...Springwell Cottage, Clapham Common
Harris, Joseph...Graysouthern, Cockermouth
Harris, Rich. ..Wootton Grange, near Northampton
Harris, Thomas ..Fletchamstead, Stoneleigh, Coventry, Warwickshire
Harris, Wm....Weston, Leamington, Warwickshire
Harrison, Anthony...Hexham, Northumberland
Harrison, Daniel...Kendal, Westmoreland
Harrison, Rev. J...Dinton, Aylesbury, Bucks
Harrison, John...Summerlands, Kendal
Harrison, John...The Bank, Bakewell, Derbyshire
Harrison, John, jun....Snelston Hall, near Ashbourne, Derbyshire
Harrison, John B...Douglas, Isle of Man
Harrison, Rev. J. H...Erdington, Birmingham
†Harrison, Richard...Wolverton, Bucks
Harrison, Rev. R. J...Caer Howell, Welshpool
Harrison, Thomas...Norris Green, West Derby, Liverpool
Harrison, Rev. T. H...Bugbrooke Rectory, Weedon
Harrison, William...Walsall, Staffordshire
Harrison, William...Bagworth Park, near Market Bosworth
Harrowby, Earl of...Norton House, Campden, Essex
Hart, Henry P...Beddingham, Lewes, Sussex
Hart, John Geo...Stowmarket, Suffolk
Hart, Thos..Wing, nr. Leighton Buzzard, Bedfordsh.
Hart, Thos. Fred...Barham House, East Hoathly, Hurst Green, Sussex
Hart, Thos. P...Housham Hall, Matching, Harlow, Essex
†Harter, Rev. G. G....Cranfield, Newport Pagnell
†Harter, J. C...Broughton Hall, Manchester
Hartley, Gilfred William...Rose Hill, Whitehaven, Cumberland
Hartley, Thomas...Gilfoot, Whitehaven
Harvey, Chas. W...2, Dale Street, Liverpool
Harvey, Edw. N...Mount House, Hythe, near Southampton
Harvey, John...Hemsworth, Wimborne, Dorset
Harvey, Matthew...Balderton, Newark, Notts.
Harvey, Robert E....Walton Priory, near Liverpool
Harvey, Maj.-Gen. Sir R. J....Moushold House, Norwich
Harvey, R. J....Brancondale, Norwich
Harwood, Samuel...Bradley Hall, Ashbourne
Haselfoot, R. C...Boreham, Chelmsford, Essex
Haselwood, Wm....Hoddesden, Herts
Haslar, Richard...Aldingbourne, Chichester, Sussex
Hassall, Wm....Hadley, Whitchurch, Salop
Hassell, John...Shelford Manor, Nottingham
Hastings, John...Longham, near East Dereham, Norfolk
Hastings, John, jun...Gressinghall, East Dereham
Hastings, John Kerr...Hereford
Hatfield, Charles T...Hartsdown House, near Margate, Kent
Hatfield, R...Thorpe Arch Hall, Wetherby, Yorksh.
Hatfield, Thomas...Yarwell, Wansford, Northampt.
Havers, Wm...Bacon's Farm, Mountnessing, near Ingatestone, Essex
Hawdon, Robert...Morpeth, Northumberland
Hawker, Admiral E...Ashford Lodge, Petersfield, Hampshire
Hawkes, Matthew...Melton Constable, Dereham, Norfolk
†Hawkesworth, R. S...Forest Mountrath, Queen's County, Ireland
Hawkins, H. M...Tredunnock, Usk, Monmouthsh.
†Hawkins, Thos...Assington Moor, Sudbury, Suffolk
Hawkins, Wm. W...St. Botolph's, Colchester, Essex
Hawks, Geo...Redheugh Hall, Gateshead-on-Tyne
Hawthorn, Wm....Benwell Cottage, Newcastle-on-Tyne
Haydon, Joseph...Guildford, Surrey
Haydon, Samuel...Guildford, Surrey
Hayne, John...Ferdington, Dorchester, Dorset
Hayne, Capt. Rich....Stanley, New Brunswick
Hayward, George...Walford House, nr. Dorrington, Shrewsbury
Hayward, Harry...Wilsford, Devizes, Wiltshire
Hayward, John...Hisland, Oswestry, Shropshire
Hayward, J. C...Quedgeley House, near Gloucester
Hayward, Joseph...Beechingstoke, Devizes, Wilts.
Haywood, Henry...Moccas, Hereford
Haywood, James...Derby
Hazlerigg, Sir A. Grey, Bt...Noseley Hall, Leicester
Heacock, Philip...Buxton, Derbyshire
Head, Charles...Hexham
Headlam, Morley...Wycliffe Rectory, Greta Bridge, Yorkshire
Headlam, T. E., M.P....Newcastle-on-Tyne
Headly, Richard...Stapleford, near Cambridge
Heanley, William...Croft, Wainfleet
Heard, W....St. Margaret's, Ware, Herts.
Hearn, John Henry...Newport, Isle of Wight
Hearsey, Rich...Greatham, near Petersfield, Hants.
Heath, Samuel...Frankton, Southam, Warwickshire
Heath, Sergeant...Kitlands, Dorking, Surrey
Heathcote, A. H...Blackwell, Bakewell, Derbysh.

†Heathcote, J. Moyer...Connington Castle, Stilton, Huntingdonshire
Heathcote, Richard...Bayterby, near Atherstone, Warwickshire
Heaton, Chas...Endon, Leek, Staffordshire
Heaton, Thos...Endon, Leek, Staffordshire
Hedding, James...Manor Farm, Chawson, near St. Neots, Huntingdonshire
Heelis, Thos....Skipton Castle, Yorkshire
Hegan, Joseph...Liverpool
Helps, Richard...Gloucester
Helyar, C. J....Poundisford Lodge, Taunton, Soms.
Hemsworth, H. D'Estere...Shropham Hall, Larlingford, Norfolk
Henchman, Fras....Kew, Surrey
Henckel, Count Hugo..Donnesmark, Siemianowitz, Königshutte, Prussia
Henderson, Edward..Lowick, Berwick-upon-Tweed
Henderson, Matthew...Landends, Hexham, Northumberland
Henderson, R...Langles Ford, Wooller, Northumb.
Hendy, James...Trethurffe, near Truro, Cornwall
Heneage, Geo. H. Walker, M.P....Compton Basset, Calne, Wiltshire
†Henley, Jos. Warner, M.P....Waterperry, near Wheatley, Oxon.
†Henning, Jas...Wolveton, Dorchester, Dorsetshire
Henning, W. L...Frome House, Dorchester, Dorsetshire
Henshall, Edward...Huddersfield
Hensman, William...Woburn, Beds.
Hensman, William, jun....Woburn, Beds.
Henty, Robert...Chichester
Hepworth, Joshua...Rogerthorp, near Pontefract
Herbert, John...Powick, near Worcester
†Herbert, John Maurice...Rocklands, Ross.
Hercy, John...Hawthorn Hill, Maidenhead, Berks.
Hereford, Viscount ..Tregoyd, Hay, Herefordshire
Herrick, William...Beau Manor Park, Loughborough, Leicestershire
Herring, John Barnwell...North Barsham, Walsingham, Norfolk
Herring, P. B...Finchley, Middlesex
Hersee, Dennett...Wepham, near Arundel, Sussex
†Hertefeld, The Baron...Liebenberg, near Berlin
Hervey, Wm...Bradwell Grove, near Burford, Oxon
Hesseltine, Wm....Worlaby House, Barton, Lincolnshire
†Hester, G. P...Town Clerk's Office, Oxford
Hetherington, Joseph Walker...Newcastle-upon-Tyne
Hetley, H...Long Orton, Peterborough, Northamptonshire
Hewer, George...Leygore, Northleach
Hewer, Wm...Hill Farm, Northleach
Hewitt, Richd....Dodford, Weedon, Northamptonshire
Hewlett, Thomas Barnard...Northampton
Hews, Richard Scott..Hoo Hall, Revenhall, Witham, Essex
Hext, Thos...Trerarren, St. Austell, Cornwall
Hey, Richard...York
Heytesbury, Lord...Heytesbury, Wilts
†Heywood, Sir Benjamin, Bart...Claremont, near Manchester
†Heywood, James, M.P...Athenæum Club
Heywood, John Thos...Brimington, near Chesterfield, Derbyshire
Heyworth, Rev. James..Henbury Hill, near Bristol
Heyworth, Ormerod...Oakwood Hall, near Stockport, Cheshire
†Hibbert, John, jun....47, Great Ormond Street
Hibbert, Nathaniel...Munden, Watford, Herts.
†Hibbert, Washington...Bilton Grange, Rugby
Hickin, John...Bourton, Dunchurch, Warwickshire
Hicks, Leonard...Paddock Lodge, Kentish Town
Hickson, Rich...Hougham, Grantham, Lincolnsh.
Higgens, Wm. W..Fairfield, Hambledon, Horndean, Hants.
Higgins, Rev. Edward...Bosbury House, Ledbury, Herefordshire
Higgins, Henry...Brinsop Court, near Hereford, Herefordshire
Higgins, John...Alford, Lincolnshire
Higgins, Wm. Thos....George Hotel, Northampton
Higgins, W. B....Pict's Hill, Turvey, Bedford
†Higginson, Edmund...Saltmarsh, Bromyard
Higginson, Jonathan....Reaseheath Hall, near Nantwich
Higginson, Rev. J....Thormanby Rectory, Thirsk, Yorkshire
Highmore, J. N....Preston Yeovil, Somersetshire
Hilder, James...Bodiam, Staplehurst, Sussex
Hilder, John...Sandhurst, Kent
Hilder, Thos.....Salehurst, Robertsbridge, Hurstgreen, Sussex
Hilditch, George...Treflach Hall, Oswestry
Hildyard, Colonel...Stokesley, Yorkshire
Hilhouse, Henry...Halstead, Leicester
Hill, Charles...Winceby, Horncastle, Lincolnshire
Hill, Charles...Great Harrowden, Wellingborough
Hill, Col. C. J....Tickhill Castle, Bawtry
Hill, Rev. Copinger..Buxhall, Stow Market, Suffolk
Hill, Clement Delves...Sandford Hall, Salop
Hill, Edw...Brierley Hill Iron-Works, near Dudley, Worcestershire
Hill, Edward...63, Gray's Inn Lane
Hill, Harcourt...Hevers Wood, Brasted, Kent
Hill, Rev. John...The Citadel, Hawkstone, Shrewsbury, Salop
Hill, Josiah...Briston, East Dereham
Hill, Robt. Broadhurst...Backe Hall, near Chester
Hill, Col. Sir Robert Chambre, Knt....Prees Hall, Shrewsbury, Shropshire
Hill, Rd. Clarke...Stallington, Stone, Staffordshire
Hills, David...Norwich
Hills, Henry...Span, Godshill, Isle of Wight
Hillyard, C....Thorpelands, near Northampton
Hilton, Henry...Sole Street House, Selling, Faversham, Kent
Hilton, Stephen Musgrave...Brambling, Wingham
Hilton, Thomas...Nackington House, Canterbury
Hincks, T. C....Breckenborough, Thirsk, Yorkshire
Hinde, Geo. T. Preston...Harmston Hall, Lincoln
†Hinde, John Hodgson, M.P....Acton House, Felton, Northumberland

Hindmarsh, Wm. C....West Horton, near Wooller, Northumberland
Hine, Thomas C....Nottingham
Hipkin, John...Singleton, near Midhurst, Sussex
Hippisley, Edw. Burgess...Chewton Mendip, Bath, Somersetshire
Hippisley, John.. Stone Easton, Bath, Somerset
Hirst, Godfrey...Longdon Hall, Knowle, Warwicks.
Hitchcock, Simon.... Allcanings, near Devizes, Wiltshire
Hoare, George Wm....The Lodge, Morden, Surrey
Hoare, Henry Chas....7, York Street, St. James's
Hoare, Sir Hugh Richard, Bart...Lillingstone, Towcester, Northumberland
Hoare, Capt. Richard..Tag's End, Hemel Hempstead
Hobbs, B....Earl's Colne, near Halstead, Essex
Hobbs, Wm....Bocking, Braintree, Essex
Hobgen, Chas....Siddlesham, Chichester, Sussex
Hobgen, J., jun....Aldingbourn, Chichester, Sussex
Hobhouse, Henry...9, King's Bench Walk, Temple
Hoblyn, D. P....Colquita, near Bodmin, Cornwall
Hobson, Edward..Stoke Park, Stapleton, nr. Bristol
Hoddenett, James...Silberlake Farm, Sherborne, Dorsetshire
Hodding, Matthias Thos....Fryem Court, Salisbury
Hodge, Henry... Lower Bossistow Vale, St. Levan, near Penzance, Cornwall
Hodgkinson, Rev. G. C.... Training Institution, York
Hodgkinson, John...Hardwicke, near Chesterfield, Derbyshire
Hodgkinson, R., sen....Morton Grange, Retford, Nottinghamshire
Hodgkinson, R., jun....Osberton Grange, Retford, Nottinghamshire
Hodgson, James...Eldon Street, Newcastle-upon-Tyne
Hodgson, Isaac Scott...14, Furnival's Inn
†Hodgson, William...Wanstead, Essex
Hodson, Rev. J. J....Yelvertoft Rectory, Rugby
Hoff, William...Halton, Spilsby, Lincolnshire
Hogarth, John... Akeld, Wooller
Hoggins, Thos....Trafford Lodge, near Chester
Holcombe, Rev. George Francis...Brinkley, Newmarket, Cambridgeshire
Holden, Edw. A....Aston Hall, Derby
Holden, Robt....Nuthall Temple, Nottingham
Holder, John...Cubberly, near Ross, Herefordshire
Holding, Henry...Shaldon, near Alton, Hants
Holdsworth, Geo...2, Upper Dorset Place, Clapham Road, Kennington
Hole, James...Knowle, Dunster, Somersetshire
Hole, William...Hannaford, Barnstaple
Hole, William...Clare House, Tiverton, Devonshire
†Holland, Dr. Charles...Rodbaston Hall, Penkridge
Holland, Sam., jun...Plasy Penrhyn, Port Maddock, Carnarvonshire
Holliday, James...Lord Street, Liverpool
Hollier, W...Walton, near Burton-on-Trent, Staffs.
†Hollist, Hasler...Lodsworth, Petworth, Sussex
Holloway, Harry...Ringwood
Holloway, Horatio...Marchwood, Southampton
Holman, John...Glastonbury, Somerset
Holmes, Fred....Tibbenham, Attleborough, Norfolk
Holmes, George...Brooke Lodge, Norwich
Holmes, Rev. John...Brooke Hall, Norwich
Holmes, John...Prospect Place, Globe Lane, Norwich
†Holmes, Hon. W. A'Court...Westover, Newport, Isle of Wight
Holton, George...Wiston, Sudbury, Suffolk
Homer, J...Martinstown, near Dorchester, Dorsetsh.
Honnywill, W. Henry...Alveston, Bristol
†Hony, Rev. P. F...25, Old Bond Street
Hony, Rev. W. E....Baverstock Rectory, Salisbury, Wiltshire
Honywood, W. P...Mark's Hall, Kelvedon, Essex
Hood, Hon. Colonel A. N....50, Grosvenor Street
Hooper, George, jun...Cottington, near Deal, Kent
Hope, Thomas Henry...Netley, Shrewsbury
Hoper, John, jun....Shermanbury, Hurstperpoint, Sussex
Hopkins, Jno....Tidmarsh House, Reading, Berks.
Hopkinson, Luke...10, Bedford Row
Hopkinson, Dr. W. Landen...St. Martin's, Stamford, Lincolnshire
Hopper, John Mason...Newham Grange, near Middlesbro.
Hopton, Rev. John...Canon-Frome Court, Ledbury, Herefordshire
Hopton, Rev. W. P....Bishop's Frome, near Bromyard, Herefordshire
Hordern, Alex...Oxley, Wolverhampton, Staffordsh.
Horlock, Frederick...Handcox Farm, Seddlescombe, Sussex
Horne, Allen...Bridge Street, Sunderland
Hornby, H...Ribby Hall, Kirkham, Preston, Lanc.
Hornby, Joseph...Everton, near Liverpool
†Hornby, Rev. R...Walton-le-Dale, Preston, Lanc.
Hornby, Rev. William....St. Michael's Vicarage, Garstang
Horncastle, John, jun...The Yews, Tickhill, Rotherham, Yorkshire
Horner, Rev. John...Mells Park, Frome, Somerset.
Hornsby, Rich....Spittle Gate, Grantham, Linc.
Hornsby, R., jun....Spittle Gate, Grantham, Linc.
Hornyold, Thos....Blackmoor Park, Great Malvern, Worcestershire
Horton, R...Audley End, Saffron Walden, Essex
Horwood, John...Stean Park, Brackley, Northamp.
†Hoskins, T...Haselbury, Crewkerne, Somersetshire
†Hoskins, W...North Perrott, Crewkerne, Somerset.
Hoskins, Kedgwin....Birch House, Ross, Herefordshire
Hoskison, John Mayon..Thiestleyfield Farm, Wilnecot, Fazeley, Staffordshire
Hoskyns, Sir Hungerford, Bart....Harewood, Ross, Herefordshire
Hotchkys, Arundell Calmady... Cleverdon House, Bradworthy, Holsworthy, Devon.
Hotson, John...Long Stratton, Norfolk
†Houblon, Richard A...Coopersall, Epping, Essex
Houghton, Henry...Baginton, Coventry, Warwickshire
Houghton, John...Broom Hall, Sunninghill, Berks.
Houldsworth, Henry...Coltness, Wishaw, N. B.

Houldsworth, Thomas, M.P....Portland Place, Manchester
Hovell, John Rayner...Soham, near Mildenhall, Suffolk
How, Wm....Hammond's End, Harpenden, Herts.
How, William Wyburgh...Shrewsbury
Howard, Charles...28, Castlegate, York
†Howard, Hon. Capt. H...Norton Court, Gloucester
†Howard, H...Greystoke Castle, Penrith, Cumberl.
†Howard, Hon. James...Hazelby, near Newbury
Howard, John...Brereton Hall, Sandbach, Cheshire
Howard, John...Bedford
Howard, W...Newcastle-upon-Tyne, Northumberl.
Howell, Henry...Driffield, Cirencester, Glostersh.
Howell, H. Williams...Glasspont, near Newcastle Emlyn, South Wales
Howell, W. Parker...7, Britannia Square, Worcester
Howes, Ephraim...Holt House, Leziate, Lynn Regis
Howey, T...Lilburn Grange, Wooller, Northumberland
Howlett, John...Bowthorpe Hall, Norwich
Hubbersty, John, C. E....
Hubbersty, Rev. Nathan...Wirksworth, Derbyshire
Hubbersty, Philip...Wirksworth, Derbyshire
Huckvale, T....Choice Hill, Chipping Norton
Huddlestone, Peter...Little Haugh, Norton, near Ixworth, Suffolk
Huddlestone, Purefoy...Norton, Woolpit, Suffolk
Hudlestone, Andrew Fleming...Hutton John, near Penrith, Cumberland
Hudson, C. S...Wick, near Pershore, Worcestershire
Hudson, George, M.P...York
Hudson, Henry, jun...Wick, near Pershore, Worc.
Hudson, John...Castleacre Lodge, Swaffham, Norf.
†Hudson, John, jun..Lower Swell, Stow-on-the-Wold
Hudson, John...Warham, Wells, Norfolk
Hudson, Peter...Warham, Wells, Norfolk
†Hudson, Thomas Moore....The Grove, Warham, Wells, Norfolk
Huggup, James...Shieldykes, near Alnwick
Hughes, Alfred...Stowe Park, Bungay
Hughes, Edw....Smeeth Hill House, Ashford, Kent
Hughes, George Hughes...Middleton Hall, Wooller
Hughes, John....Donnington Priory, Newbury, Berks.
Hughes, John...Phennant, near Wrexham
Hughes, Samuel...Bristol
Hughes, William...Browning's Grove, Blackboys, Hurst Green, Sussex
Hugill, John...Whitby
Hulme, James Hilton...Manchester
Hulme, Wm...Pembroke Bank, Pembroke, S. W.
Humbert, Charles F....Watford, Hertfordshire
Humble, Edw.....Renishaw, Chesterfield, Derbysh.
Hume, John...Beau Regard, Jersey
Humfrey, John...Upton, Wallingford, Berkshire
Humfrey, Robt. Blake...Wroxham House, Norwich
Humphreys, E....Walcot, near Montgomery
Humphreys, John...Evenhall, Oswestry, Salop
Humphreys, John...Berriew Rectory, Welshpool, Montgomeryshire
Humphries, John...Cranmere, near Bridgnorth, Salop
Hunloke, Sir H., Bart....Wingerworth Hall, Chesterfield
†Hunt, Geo....The Grange, Broughton, Preston, Lanc.
Hunt, Henry John...High Street, Lambeth
Hunt, John...Thornington, near Wooller, Northumberland
Hunt, John...Shirley, Southampton
Hunt, Joseph...Addlesthorpe, Spilsby
Hunt, Robert...Aldeby, near Beccles
Hunt, W. A...St. Mary's Street, Stamford, Lincolns.
Hunt, Wm....Bretton Park Office, near Wakefield, Yorkshire
Hunt, William...Leicester
Hunt, Zachary D....Aylesbury, Buckinghamshire
Hunter, Henry L....Beech Hill, Reading, Berkshire
Hunter, Wm....Lovaine Row, Newcastle-on-Tyne
Hurle, John...Clifton, Bristol
Hurley, Rich....Gadden House, Uffculm, Collumpton, Devonshire
Hurry, J.. Knarefen, Thorney, Whittlesea, Cambs.
Hurt, Francis...Alderwasley, Belper, Derbyshire
Hurt, Francis, jun....Duffield, near Derby
Hurt, Richard...Wirksworth, Derbyshire
Hurwood, George...Ipswich, Suffolk
Hussey, Edw....122, Park Street, Grosvenor Square
†Hussey, Richard H....Upwood, Huntingdon
Hussey, Thomas...Waybrook, Alphington, Exeter
Hussey, Thos....Hambledon, Henley-on-Thames, Oxon
Hutchins, John...Waltham, Melton Mowbray
†Hutchison, John...Monyrny, Peterhead, N. B.
Hutchinson, Rich....Stanhope, Weardale, Durham
Hutchinson, Hon. Col. H. H...Weston House, Towcester
Hutley, Jonathan...Rivenhall Hall, near Witham, Essex
Hutley, William...Pounds Hall, Witham, Essex
Hutt, John...Water Eaton, near Oxford
Hutt, William...Thrupp, Woodstock, Oxon
Hutton, Rev. H...Rector of Filliegh, South Molton
Hutton, John...Sowber Hill, Northallerton, Yorksh.
Hutton, Thos...Upton Gray, near Odiham, Hampsh.
Hutton, Wm...Gate Burton, Gainsborough, Lincolnshire
Huxtable, Rev. Anthony...Sutton Waldron, Shaftesbury, Dorsetshire
Hyde, Francis C....Syndale, Feversham, Kent
Hyde, Thomas...Manor House, Maidstone

Ide, John...West Wittering, Chichester, Sussex
Ilbert, William R....3, Cavendish Crescent, Bath
†Iles, F...Barnoldby-le-Beck, Grimsby, Lincolnsh.
Iles, John...Binbrook Hill, Market Rasen
Inett, W...Asfordby, Melton Mowbray, Leicestersh.
Inge, Captain W....Thorpe, near Tamworth, Staffs.
Ingham, Robert...Westoe, near South Shields
Ingle, Thomas...Belper, Derbyshire
Ingle, Thomas, M.D....Wood Hall, Hilgay, Norfolk
Ingram, Herbert...198, Strand
Ingram, Hugh...Steyning, Sussex
Ingram, Hugo F. M....Hoarcross, Rugeley, Staffs.
†Ingram, Rev. James...Trinity College, Oxford

†Ingram, John Andrew...Codford St. Peter, Warminster, Wilts.
Instone, Thomas...Calaughton, Wenlock, Salop.
†Ireland, I. Ireland C....Brislington, near Bristol
Ireland, Philip...Muckleton, near Shrewsbury
Isaacson, John...Clare, Suffolk
Isaacson, Wm. Parr...Newmarket, Cambridgeshire
Isham, Sir C. E., Bart...Lamport Hall, Northampton
Isham, Rev. Robt...Lamport Rectory, Northampton
Ivatt, Robert...Cottenham, Cambridgeshire
Ivens, Thomas...Lutterworth, Leicestershire
Ives, George...Norwich
Ives, Capt. Ferdinand..St. Catherine's Hill, Norwich
Iveson, John...Marlborough, Wilts.
Izon, John...Sowe, Coventry

Jackson, Daniel...Boston, Lincolnshire
Jackson, Geo. V... Carramore, Ballina, Ireland
Jackson, Hugh...Wisbeach, Cambridgeshire
Jackson, John S....Eastham, near Chester
Jackson, John...East Haddon Grange, near Northampton
Jackson, Matthew...Bilsthorpe, near Southwell Notts.
Jackson, W. K....Barbot Hall, Rotherham
Jacson, Charles R....Myerscough Cottage, Preston, Lancashire
James, Rev. Chas. Thos....Exeter College, Oxford
James, C. F....Kirknewton, near Wooller, Northumberland
James, Edward...Wylam Hall, Newcastle-on-Tyne
James, Herbert G....243, Whitechapel Road
James, Joseph R....Burnewhall, St. Buryan, Penzance, Cornwall
James, Robert...Carden Thursby, near Carlisle, Cumberland
James, Thomas...Brandon, Wooller, Northumb.
James, Thomas...Otterburn Tower, Newcastle-on-Tyne
James, William...King Street, Hereford
†James, Captain W. E....Barrock Lodge, Carlisle
James, William P....Pantglasse, Trelleck, near Monmouth
Jarratt, George Jarratt...Elmfield House, Doncaster
†Jarrett, John...Camerton House, Bath, Somerset.
Jarvis, Sir R. ..Cove Cottage, Ventnor, Isle of Wight, Hants
Jebb, George...The Lyth, Ellesmere, Salop.
Jecks, Charles...Thorpe, Norwich
Jefferson, Rev. J. D....Thicket Priory, Escrick, near York
Jefferys, N. N....Hollybrook House, Shirley, near Southampton, Hants
Jeffkins, George....2, Crosby Square, Bishopsgate Street
Jeffs, Wm....Costow House, Marston St. Lawrence, Northamptonshire
Jeggo, Thos. Bayley ..Pear Tree, Gosfield, Halstead, Essex
Jelley, Thomas...Tickencote, Stamford
Jenkins, G. John...Pantirion, near Cardigan, S. W.
†Jenkins, John, jun...Caerleon, Monmouthshire
Jenkins, Richard David...Cardigan
Jenkinson, Joseph...Millwich, Stone, Staffs.
Jenner, Arthur Rice...Chislehurst, Kent
Jenner, Montagu Herbert.. Chislehurst, Kent
Jenner, Robt. Fras...Wenvoe Castle, Cardiff, S. W.
Jennings, J. C.. Evershot, Dorchester, Dorsetshire
Jennings, Richard...21, Portland Place
Jennings, Robt. F....Little Belshanger, Sandwich, Kent
Jenyns, Geo....Bottisham Hall, Cambridge
Jermyn, Earl, M.P....Bury St. Edmund's
Jersey, Earl of...Middleton Park, Bicester, Oxon
Jervoise, Samuel Clarke.. Porter's Shenley, Barnet, Hertfordshire
Jessop, Joseph...Grove Farm, Chiswick, Middlesex
Jessop, Wm...Butterley Hall, Alfreton, Derbyshire
Jesty, Charles...Holywell, Evershot, Dorchester, Dorset.
Jesty, Thomas ..Druce Farm, Piddleton, Dorset.
Jewett, Llewellyn...Headington, Oxon.
Jex, William...Hopton, Gt. Yarmouth, Norfolk
Jobling, John ....Seaton Lodge, North Shields, Northumberland
Jobling, J. C...Newton Hall, Newcastle-on-Tyne
Jobling, Mark L...Percy Street, Newcastle-on-Tyne
Jobson, Thomas...Bank Farm, Shrewsbury
Jobson, William...Glanton by Alnwick, Northumberland
Jodrell, Sir Rd. Paul, Bart....Sall Park, Reepham, Norfolk
Johnson, Cuthbert Wm...Waldronfield, Croydon
Johnson, Edward...The Deanery, Chester-le-Street
Johnson, Fras. Dixon...Aykley Heads, Durham
†Johnson, George...Blaco Hill, Retford, Notts.
Johnson, George...Willington, Newcastle-on-Tyne
†Johnson, Rev. H. Luttman....Binderton House, Chichester, Sussex
Johnson, John G...64, St. Giles's Street, Norwich
Johnson, John G....Bentley, near Ashbourne, Derbyshire
Johnson, Joseph...Ravenswood, Manchester, Lancashire
Johnson, Rev. N. P...Aston-on-Trent, near Derby
Johnson, Rev. P...Wimborthy, Chumleigh, Devon
Johnson, Robert...Westborough, Long Bennington, Newark, Notts.
Johnson, Samuel...Somersall Hall, Chesterfield, Derbyshire
Johnson, T. C....Chevet, Wakefield
Johnson, Theophilus F...Spalding, Lincolnshire
Johnson, Thomas ..Cheapside, Leicester
†Johnson, Thomas...Whittlesey, Cambridgeshire
Johnson, Walter...East Field, Warkworth, Northbd.
Johnson, William B...Strathfieldsaye, Hants.
Johnston, Charles ..Claramount, Cheshunt
Johnston, John A...Crondall, Farnham, Surrey
Johnstone, George...53, Tavistock Square
†Johnstone, Rev. George...Broughton, Hunts
Johnstone, Capt. J...Ashfold, Crawley, Sussex
†Jolliffe, Col. J. T...Amnerdown Park, near Bath
Jolliffe, Sir Wm. G. H., Bart., M.P...Heath House, Petersfield
Joly, Fred...4, Hatton Court, Threadneedle Street
Jonas, Samuel...Ickleton, Saffron Walden, Essex

Jones, Anthony Gilbert...Gloucester
Jones, Benjamin H...Lark Hill, Liverpool
Jones, Charles...Poole Keynes, Cirencester
†Jones, David...Blaennose House, Llandovery
Jones, Edward...94, High Street, Borough
Jones, Edward...6, York Crescent, Clifton, Bristol
Jones, George...Lower Hill, Hereford
Jones, George...Stanton, near Warwick
Jones, John...Pant-y-Corred, Brecon, Brecknockshire
†Jones, John...Blaennose House, Llandovery
Jones, John...Harrington, Spilsby, Lincolnshire
Jones, John...Glanhonddû, near Brecon
Jones, John Edw...Baysham, Ross, Herefordshire
Jones, J. H. W....Chastleton, Chipping Norton, Oxon
Jones, J. O...Dollycorsllwyn, Welshpool, Montgomeryshire
Jones, Matthew Easton...Henningwell Lodge, Wellingborough, Northamptonshire
Jones, Matthew Edw....Stalloe, Montgomery
Jones, R. P....The Hermitage, Whitchurch, Salop
Jones, Thos...Kensworth, Market Street, Herts.
†Jones, Sir Willoughby, Bart.... Cranmer Hall, Fakenham, Norfolk
Jones, Walter David, M.D... Lancych, Newcastle Emlyn, S. W.
†Jones, Wm....Harrington, Shiffnal, Shropshire
Jones, Wm....Waterloo Villa, Spa, near Gloucester
Jones, Wm...Record Street, Ruthin, Denbighshire
†Jones, Wm. Bence...Kilgariff, Clonakilty, Ireland
Jones, Wm. T...Gwynfryn, near Aberystwith
Jordan, Francis...Eastburn, Driffield
Jordan, G. B. J....Pigeonsford, Newcastle Emlyn, S. Wales
Jordan, Wm....Charlton Kings, near Cheltenham, Gloucestershire
Josselyn, John...Sproughton, Ipswich, Suffolk
Jowett, Rev. J. F....Kingston, Bagpuze, Abingdon, Berks
Joyner, Henry St. John...Chadwell Place, Grays, Essex
Juckes, Richard...Cotwall, Wellington, Shropshire
Juckes, Thos....Tearn Farm, Wellington, Shropshire
Julian, John...Bury, Huntingdon
†Justice, Henry...Hinstock, Market Drayton, Salop
Justice, Rev. John...Ightfield, Whitchurch, Salop
Jutsum, Edward...Gibbs-at Perry, Romford, Essex

Karkeek, W. F...Truro
†Kay, John Robinson...Bass Lane House, Bury, Lancashire
Kay, Richard...Hansfield, Rochdale, Lancashire
Kaye, Lister L...Denby Grange, Wakefield
Keary, H. W...Longlands, Holkham, Norfolk
Keeling, Chas...Congreve, Penkridge, Staffs.
Keen, Jas...Weston Park, Campden, Gloucestersh.
Keen, Thomas...Croydon, Surrey
Kekewich, S. T...Peamore, near Exeter
Kelham, R. K...Bleasby, Southwell, Notts.
Kell, William.. Gateshead, Durham
Kelsey, Fred. J...West Lavington House, Wiltshire
†Kemble, Horatio...Leggatts, near Hatfield, Herts.
†Kemble, Thos...Leggatts, near Hatfield, Herts.
Kemp, James C....Liverpool
Kemp, Jesse...Thurlby Grange, near Alford, Lincolnshire
Kempson, J., jun.. Birchyfields, Bromyard, Herefordshire
Kendall, John ..Hog Hall, Burbage, Hinckley
Kendall, Nicholas...Pelyn, near Lostwithiel, Cornwall
Kendall, Samuel...East Moulsey, near Kingston, Surrey
Kendle, C. J...Fordham, Downham Market, Norfolk
†Kennaway, Sir John, Bart..Escot, Honiton, Devon.
Kennett, Rich...Lagenhoe Wick, Colchester, Essex
Kent, John...Mortimer, Reading
Kenward, J. W...Fletching, near Uckfield, Sussex
Kenyon, Hon. Thomas...Pradoe, Oswestry
Keppel, Hon. and Rev. Thomas..North Creake, Fakenham, Norfolk
Kerl, Wm...1, Hans Place, Sloane Street
Kerr, Robt...Heywood, near Kington, Herefordsh.
†Kerrich, John.. Geldeston Hall, Beccles, Norfolk
Kerrison, E. C....31, Old Burlington Street
Kerrison, John...Ranworth, Norwich
Kersey, Henry...Helmingham, Stoneham, Suffolk
Kersey, James..Tarlton Farm, near Cirencester
†Kesterton, Thomas ... Woodlands, Leatherhead, Surrey
Kett, Geo. S...Brook House, Norwich, Norfolk
Keyworth, Joseph...Spital, Lincolnshire
Kidstone, Thos....Prospect Hall, Horn Hill, Chalfont St. Peter's, Rickmansworth
Kilby, George...Queniborough, Rearsby, Leicestershire
Killick, Henry...Liverpool
†Kinder, John...Sandridge Bury, St. Alban's, Herts.
Kinder, Thomas....Sandridge Bury, St. Alban's, Herts.
†Kinderley, Geo. Herbert...Kilpaison, Pembrokeshire
King, Benj...Bilsden Hall, Chipping Ongar, Essex
†King, Chas...Little Brinton, Northamptonshire
King, Charles...New Cottage Farm, Potter's Bar, Barnet
King, E. B...Umberslade, Henley-in-Arden, Warwickshire
†King, Fielder...Buriton, Petersfield, Hampshire
†King, Frederick...Oxford
King, James...Dullingham, Cambridge
King, Rev. James...Longfield Court, Dartford, Kent
King, James K....Staunton Park, near Leominster, Herefordshire
King, Rev. J. M....Cutcombe Vicarage, Dunster, Somersetshire
King, Hon. P. J. Loche, M.P....Woburn Park, Chertsey, Surrey
King, R. K. Meade...Walford, near Taunton, Somerset
King, R. Meade...Pyrland Hall, Taunton, Somersetshire
King, W. F...Wincanton
Kingdon, Rev. S. N...Bridgerule Vicarage, near Holsworthy

†Kingscote, Thos...Kingscote, Tetbury, Glostsh.
Kingsford, John...Esher, Surrey
†Kingsmill, Wm....Sydmonton Park, Newbury, Berkshire
Kinlock, Col. John...Logie, Kirriemuir, N. B.
†Kirk, Richard...Gale Bank, Leybourne, Wensley Dale, Yorkshire
Kirkby, Thomas...Cuxwold, Caistor
Kirkham, John...Hagnaby, Spilsby, Lincolnshire
Kirkland, Sir John...80, Pall Mall
Kirkpatrick, William ...Delves House, Ringmer, Lewes, Sussex
Kirsopp, James...The Spittal, Hexham, Northumb.
Kitton, John...Norwich
Knatchbull, H. E....Elmham Vicarage, East Dereham
Knatchbull, Rev. Wadham...Cholderton Lodge, Amesbury, Wilts
†Knatchbull, William...Babington, Frome, Somersetshire
Knight, C. A...Simondsbath, Southmolton, Devon
Knight, Edw....Godmersham Park, Canterbury, Kent
Knight, Edw., jun...Chawton House, Alton, Hants
Knight, John B...West Lodge, Dorchester, Dorset.
Knight, Richard...Dunton Hall, Brentwood, Essex
Knight, Richard...Headley, Liphook, Hampshire
Knight, Rev. Robt....Tythegston Court, Bridgend, Glamorganshire
Knight, Thomas...Norlington, near Lewes
Knight, Thos...Bobbing Court, Sittingbourne, Kent
Knight, Thos...Edmonton, Middlesex
Knightley, Sir Charles, Bart., M.P...Fawsley Park, Daventry, Northamptonshire
†Knighton, Sir William, Bart...Blendworth Lodge, Horndean, Hants
Knipe, J. A...Manor Street, Clapham
Knollis, J. E...Langford, Brandon, Norfolk
Knollys, Colonel...Blount's Court, Henley, Oxon
Knowles, Joshua...Stormer Hill, Tollington, near Bury, Lancashire
Knowles, Joshua...Old Manor House, Tinsley, near Sheffield
Kynaston, Cabot...Caldy Island, Tenby
Kynnersley, T. C. Sneyd...Loxley Park, Uttoxeter, Staffs.
Kyrke, Richard V...Pendrell Cottage, Wrexham

Laborn, Daniel...Eske, Beverley, Yorkshire
Labrey, John...Yew Cottage, Huddersfield
Lacey, Wm...Adboulton House, Nottingham
Lacey, W. Chas....Sutton, Carshalton, Surrey
Lacon, Sir Edmund H. K., Bart...Somerton Hall, Great Yarmouth, Norfolk
La Coste, Thos. B...Abbey Mills, Chertsey, Surrey
Ladbroke, Felix...Hedley, Epsom, Surrey
Ladds, James...Deanshanger, near Stony Stratford, Bucks.
Ladds, Wm....Ellington, North Huntingdon
Laidler, Matthew...West Fenton, near Wooller
Laidler, Thomas...Fenton, near Wooller
Lake, Machin...Saham, Watton, Norfolk
Lake, Robert...Milton, near Canterbury, Kent
Lamb, Joseph...Axwell Park, Newcastle-on-Tyne
†Lamb, William...Hay Carr, Ellel, Lancaster
Lamb, William...Cranwell Grange, near Sleaford, Lincolnshire
Lamb, Wm....Fair Mile, near Henley-on-Thames Oxon
Lambard, Wm...Beechmont, Seven Oaks, Kent
Lambert, Wm. Chas....Knowle House, Wimborne, Dorsetshire
†Lamothe, Fred. J. D...Ramsey, Isle of Man
Lamprell, Wm...Little Bradley Hall, Newmarket
Lance, Edwd. J...Blackwater, Bagshot, Surrey
Lance, Rev. John E...Buckland St. Mary, Chard, Somerset
†Landor, H. Eyres...Warwick
Landor, Thomas...Burton-on-Trent, Staffordshire
Lane, John...Barton Mill, Cirencester, Gloucest.
Lanfear, Thos...Avington, Hungerford, Berks.
Langdale, Hon. Charles...Houghton Hall, Market Weighton, Yorkshire
Langdale, Marmaduke R....Garston House, Godstone, Surrey
†Langford, Fred...Udimore, near Rye
Langham, Herbert...Cottesbrooke, Northampton.
Langlands, John Chas...Bewick, near Alnwick
Langley, Henry...2nd Life Guards
Lansdale, R., jun...Worsley Hall, Manchester
Lanwarne, Nicholas...St. John Street, Hereford
Large, Charles...Broadwell, Lechlade, Gloucest.
Large, John...Hill Field, Combe Abbey, Coventry
Lasham, R. S...Woodlands, Westmeon, near Petersfield, Hants
Latham, R. Cousins...Clifton Hampden, near Abingdon, Berkshire
La Touche, David...Marlay, Dublin
Lattimore, Chas. Higby....Wheathampstead, St. Alban's, Herts.
Lavender, William...Biddenham, Bedford
†Law, Rev. R. V...Christian Malford, Chippenham, Wiltshire
Lawes, John Bennet...Rothamsted Park, Harpenden, Herts
Lawford, Edward...Leighton Buzzard, Bedfordsh.
Lawford, John...Mount Pleasant, Tottenham, Middlesex
†Lawford, Thomas, jun. ..Tirydail, near Llandilo, Carmarthenshire
Lawford, Wm. R....Oerley Hall, near Oswestry, Salop
†Lawley, Hon. Beilby R...Escrick Park, York
Lawley, Hon. and Rev. S. W...Escrick Rectory, York
Lawrance, T. M...Dunsby Hall, Folkingham, Lincolnshire
Lawrance, Wm ..Peterborough, Northamptonshire
Lawrence, Charles...Cirencester, Gloucestershire
Lawrence, George...Cowsfield, Salisbury, Wilts.
Lawrence, Capt. I. R....East Harptree, near Bristol, Somersetshire
Lawrence, Wm. E...The Greenway, Cheltenham
Lawrence, Wm. Scott...Stapleton, near Bristol
Lawson, Andrew, M.P....The Hall, Boroughbridge, Yorkshire
†Lawson, C...George the Fourth's Bridge, Edinbro.

Lawson, Edw....Redesdale Cottage, Newcastle-on-Tyne
Lawson, Robt...Everley Lodge, East Barnet, Herts.
Lawson, William...Longhirst Hall, Morpeth
Lawson, Sir Wm., Bart...Brough Hall, Catterick
Lawton, J. B..Newark, Nottinghamshire
Lax, George...Wells, Somersetshire
Lax, J., jun...East Horsington, Wells, Somerset
Lax, William...Darlington
Laxton, R. W...Morbone, Stilton, Hunts.
Laxton, William...Pinchbeck, Crossgate, Spalding
Lay, John G...Great Tey, Colchester, Essex
Laycock, Joseph...Lintz Hall, Newcastle-on-Tyne
Laye, Lieut. H. T., R.N...8, Albion Place, Scarboro.
Layton, Robt. M....Thorney Abbey, Peterborough, Northamptonshire
Layton, William...Soham Place, Mildenhall
Lea, John...Ellesmere, Salop
Leach, Frederick...Grove Mill, Watford, Herts.
Leach, George...Stoke, Devonport, Devonshire
Leach, Henry...Corston, near Pembroke
Leake, Lieut.-Col. Robert Martin....Woodhurst, Oxted, near Godstone, Surrey
Leamon, Robert...Whitwell, Reepham, Norfolk
Leche, John Hurleston...Carden Park, Chester
Ledger, Reuben...Knotty Ash, near Liverpool
Lee, Charles...Coldrey House, Alton, Hants.
Lee, Charles ...Ellington Masham, Bedale, Yorksh.
Lee, Edward...Stocksfield Hall, Newcastle-on-Tyne
Lee, George B....Frampton, Dorchester, Dorset
Lee, Joseph...Dilston, Hexham, Northumberland
Lee, Joseph, jun....Red Brook, Whitchurch, Salop
†Lee, J. L...Dillington House, Ilminster, Somerset.
Lee, Richard...Grove Hill, Ferrybridge
Leech, John...Wall Hill, Leek, Staffordshire
Leedham, William ...Westbury Hill, near Bristol
Leeds, Henry...Stibbington, near Wansford, Northamptonshire
Leeke, Ralph...Longford Hall, Newport, Salop
Lees, William...Bakewell, Derbyshire
Leese, Benjamin...Eastling, Faversham, Kent
Legard, George...Fangfoss, Pocklington, Yorkshire
Legard, Capt. J. A....Lenton Hall, Nottingham
Legh, G. C., M.P....High Leigh, Warrington, Lanc.
Legh, Peter...Norbury Booth Hall, Knutsford
Legh, Richard...Fox Hall, Oswestry
†Leigh, Capel H...Pontypool Park, Montgomerysh.
Leigh, Rev. John...Egginton Rectory, near Derby
Leighton, Sir Baldwin, Bt...Loton, Shrewsbury
Leir, Rev. W. M....Ditcheet, Castle Carey, Somersetshire
†Leith, Sir Alexander...Freefield and Glentindie, Aberdeenshire, N.B.
†Lempriere, Capt. G. O....Pelham Place, Alton, Hampshire
Leslie, Chas. Powell...Glasslough, Ireland
Lethbridge, A. G...Sandhill Park, Taunton, Somersetshire
Lethbridge, J. K...Tregeare, Launceston, Cornwall
Lett, Joseph...Rushock, Kidderminster
Leuw, Dr. de...Gräfrath, Elberfeld
Leven and Melville, Earl of...Melville House, Fife, N.B.
Levett, John...Wicknor Park, Lichfield, Staffs.
Levi, William...Woughton House, Fenny Stratford, Bucks.
Levick, Henry...West Woodhay, Newbury
Lewellin, Daniel...Tremains, Bridgend
Lewes, Rev. Thos...Taynton, Burford, Oxon
Lewis, A. M....Nether Wallop, Andover, Hants
Lewis, David...Stradey, Llanelly, near Carmarthen
Lewis, Edward...Hertingfordbury, near Hertford
Lewis, Israel Harris...Gallants Court, East Farleigh, Maidstone
Lewis, Laurance...Northington, near Alresford
Lewis, Thos....Norchard, near Pembroke
Lewis, W. H....Clynfiew, Newcastle Emlyn, Carmarthenshire
Ley, Rev. Henry...Kenn, near Exeter
Ley, John Henry...Treehill, near Exeter
Ley, John H., jun....Treehill, near Exeter
Lichfield, Coventry H....Golder Farm, Tetsworth, Oxon
Lidbetter, Richard...Bramber, Steyning, Sussex
Liddell, Henry George...Eslington House, Whittingham, Northumberland
Liddell, Hon. H. T., M.P....Ravensworth Castle, Gateshead
Lilford, Lord...Lilford Hall, Oundle, Northampsh.
Limerick, Earl of...Ditcham Park, near Petersfield
Lincoln, Earl of, M.P....Ranby Hall, Retford, Nottinghamshire
Lindley, Urban ....Radmanthwaite House, near Mansfield, Notts.
Lindsell, Robert...Biggleswade, Bedfordshire
Lindsell, Thos....Hemingford, St. Ives, Hunts.
Ling, Henry...24, St. Giles's Street, Norwich
Linnell, Rich...Stowe, Weedon, Northamptonshire
†Linton, Rev. Jas....Hemingford, St. Ives, Hunts.
Linzee, Robert G....Hampton Lodge, Farnham, Surrey
Lishman, William..Fenwick Shield, Stamfordham, Northumberland
Lismore, Viscount...Shambally Castle, Clogheen Ireland
Lister, William...Dunsa Bank, Richmond, Yorksh.
Lithgow, George...Stanway, Colchester
Little, R. D...Chippenham
Little, Wm. Hunter...Llanvair Grange, Abergavenny, Monmouthshire
Littledale, Harold...Liscard, near Liverpool
Littledale, Henry...Cardington, near Bedford
Littledale, Henry A....Bolton Hall, Clitheroe
†Livesey, Joseph ..Stourton Hall, near Horncastle, Linc.
†Llewellin, Richard...Tregwynt, Fishguard, Pembrokeshire
Llewellyn, Pearce...Merrian Court, near Pembroke
Llewellyn, Wm...Greenfield, near Neath, S. W.
Llewellyn, Wm....Courtcolman, Bridgend, S. W.
Llewelyn, J. D....Pullengare, Swansea, S. W.
Lloyd, Edward H....Aston Hall, Oswestry
Lloyd, Geo. P....Plasyndre, Bala, Merionethshire
Lloyd, J. A. ..Seaton Knolls, Shrewsbury, Shropsh.
Lloyd, Llewellyn...Pontriffith Hall, Mold, Flintshire

Lloyd, L. F....Nannerch Hall, Mold, Flintshire
Lloyd, Rev. Thos....Rectory, Christleton, Chester
Lloyd, Thos....Langley, Ludlow, Shropshire
Loader, Caleb...Gomaldon, Salisbury, Wiltshire
Loat, Wm. John...Clapham Common, Surrey
Lock, George...Blandford, Dorsetshire
Lock, Thos....Higher Kingston, Dorchester, Dorset
†Loft, William...Trusthorpe, Alford, Lincolnshire
Long, Rev. C. M....Settrington, Malton
Long, Henry Laws...Hampton Lodge, near Farnham, Surrey
Long, John...Marwell Hall, Winchester
†Long, Kellett R....Dunstan Hall, Norwich
†Long, Richard P....Rood Ashton, Trowbridge
Long, Robert...Overton, near Marlborough, Wilts.
Long, Walter...Preshaw House, Bishop's Waltham, Hampshire
Long, Walter Jervis....Preshaw House, Bishop's Waltham, Hampshire
Long, Wm....Hurt's Hall, Saxmundham, Suffolk
Longbourne, John....Bouville's Court, Saundersfoot, Tenby, Pembrokeshire
Longbourne, W. T....4, South Square, Gray's Inn
Longcroft, C. R...Llanina, Abereyron, Cardiganshire
†Longe, John...Spixworth Park, Norwich, Norfolk
Longmore, George...Orleton Court Farm, Ludlow
Longridge, Wm. Smith...Bedlington Iron Works, Newcastle-on-Tyne
†Loomes, Edward...Whittlesea, Cambridgeshire
Lopes, Massey...Maristow, near Plymouth, Devon
Lopes, Sir Ralph, Bart., M.P....Maristow House, near Plymouth, Devon.
Loraine, Edward...1, St. Thomas Street, Newcastle-on-Tyne
Loraine, John L...Newcastle-on-Tyne
†Lord, John...Standish Hall, Wigan
Loscombe, Francis...Goodworth, Chatford, Andover
Loud, George H....Buckland, Dover, Kent
†Loud, H. F....Herne Bay, Kent
Love, Peter...Manor House, Naseby, Northamptonshire
Love, Samuel...Castle Farm, Shoreham, Dartford, Kent
Loveband, John.... Parsonage, Bishopsnympton, South Molton
Loveday, John...Williamscote, Banbury, Oxon
Lovel, Rich....Edgecot Lodge, near Banbury
† Lovell, Edwin...Dinder, Wells, Somersetshire
†Lovell, Thomas, jun....West Haddon, Daventry, Northamptonshire
Lovett, Joseph V.... Belmont, Oswestry, Salop
Lovick, James J....Thorpe, Norwich
Low, Joseph...Hill Hall, Gt. Bardfield, Braintree
Lowdell, George...Baldwin's Hill, East Grinstead
Lowe, John...Ryhall, Stamford, Lincolnsh.
Lowe, John...Birmingham
Lowe, Peter...Marston, Stafford
Lowe, Richard...Park Street, Bristol
Lowe, Wm....The Lea, Cleobury Mortimer, Salop
Lowman, Robert...Crewkerne, Somerset.
Lowndes, Richard Chas....Rice House, Clubmore, Liverpool
†Lowndes, William Layton...Morville Hall, Bridgnorth, Salop
Lownds, Robert...Tatten Hall, near Chester
Lowrey, Stephen...Shieldfield House, Newcastle-on-Tyne
Lowrey, Wm....Barmoor, near Wooller, Northumb.
Luard, Godfrey..Blyborough Hall, Spital, Lincolns.
†Lubbock, Sir J. Wm., Bart...23, St. James's Place
Lucan, Earl of...Laleham, Staines, Middlesex
Lucas, George...Newport Pagnell, Bucks.
Lucas, Henry...Uplands, Swansea, Glamorganshire
Lucas, Joseph...Rowsham, Aylesbury, Bucks.
Lucas, Lieut. Richard....Edith Weston, Stamford, Lincolnshire
Lucas, Rev. W....Burgh, near Acle, Norfolk
Luckham, Levi...Broadway, near Weymouth, Dorset
Lucy, Rev. J....Hampton Lucy, Stratford-on-Avon, Warwickshire
Lucy, William F....Charlecote Park, Stratford-on-Avon
Ludgater, John...Stiffkey, Wells, Norfolk
Ludlow, H.G.G...Heywood House, Westbury, Wilts.
†Lugar, Henry...Hengrave, Bury St. Edmund's
Lumbert, R. C....Burghfield Hill, Reading, Berks.
Lumsden, John...Moussen, near Belford, Northumberland
Lungley, Brooke M...Peyton Hall, Boxford, Suffolk
Lunn, J. W....South Ferriby, Barton-on-Humber, Lincolnshire
Lunn, Robt., jun....Norton, Evesham, Worcesters.
Lush, Joseph...Kilmington, Mere, Wilts
Lushington, Sir H., Bart....32, Montague Square
Luttrell, Rev. Alexander H. F....Minehead Vicarage, near Bridgewater, Somersetshire
Luxmoore, Rev. C. T. C....Guilsfield, Welch Pool, Montgomeryshire
Luxton, Robert George...Brushford, Crediton
Lyndhurst, Lord .... Turville Park, Henley-on-Thames
Lyne, Wm....Oddington, near Stow-on-the-Wold, Gloucestershire
Lyon, C. W....Silver Hill, Lichfield
Lyon, Captain Jas....Dangstane, Petersfield, Hants
†Lyon, J. W....Miserdine Park, near Cirencester, Gloucestershire
Lysoght, Admiral Arthur...Bath
Lyttleton, Hon. and Rev. W. H...Kettering, Northamptonshire

Mabbett, John...Stinchcombe, Dursley, Gloucest.
†Mabbott, William Courthorp...Southover Priory, Lewes, Sussex
+MacDonald, Sir Arch., Bart....Woolmer Lodge, Liphook, Hants
MacDonald, Rev. Douglas...West Alvington, Kingsbridge, Devonshire
MacDonald, Wm. M....Rossie Castle, Montrose, Forfarshire
†MacDougall, A. H....44, Parliament Street
†MacDowall, J. C. S....New Freugh, near Patrick's Plains, Upper Hunter, Sydney, N. S. W.
MacDuff, Capt...Blair Castle, Blair Athol, Perthsh.
†MacEwen, James...Tregothnan, Truro

Machin, J. Vessey...Gateford Hill, Worksop, Notts.
Mackrell, William....Collingbourne Kingstone, Marlborough, Wiltshire
Mackworth, Lieut.-Col. Sir Digby, Bart...Glanusk, Caerleon, Monmouthshire
MacLagan, Peter....Invercauld by Ballater, Aberdeenshire
Maclean, Allan, M.D....Colchester
†Macleod, Norman...
MacNicoll, John Craig...Alyth, Forfarshire, N.B.
†MacNiven, Charles...Perrysfield, Oxted, Surrey
MacTaggart, James...Foxlease, near Lyndhurst
†Maddison, George W....Partney, Spilsby
Maddison, Thomas...Wandon, Wooller, Northumb.
Maddox, Alfred...Ringland Hall, Cossey, Norfolk
Maddy, Thomas Watkin...Sutton Court, Hereford
Maher, J. H....Lynn, Norfolk
Maidens, Thomas Cousins...Brinkhill, Spilsby
Maine, Rev. J. T...Bighton Hall, Alresford, Hants.
†Mainwaring, C. K...Oteley Park, Ellesmere, Salop
†Mainwaring, Rev. James....Bromborough Hall, Chester
†Mainwaring, Townshend, M.P....Marchiviel Hall, Wrexham, Denbighshire
Maitland, Capt. Fred. Thos....Hollywick, Hartfield, East Grinstead, Sussex
Maitland, John G....Surrey Villa, Lambeth, Surrey
Maitland, William Whitaker...Chigwell, Essex
Majendie, Ashhurst...Hedingham Castle, Essex
Major, Stephen..Stanhorn Green, near Hungerford, Berkshire
†Malcolm, Lieut.-Col. George A..17, William Street, Lowndes Square
Male, Henry...East Chinnock, Yeovil, Somerset
Malins, George W. R....Thelsford, near Barford, Warwickshire
Mallinson, John...Thick Hollins, Huddersfield
Malloch, C. H.... Court-House, Cockington, Devon
Malmesbury, Earl of...Heron Court, Christchurch, Hants
†Maltby, Edward Harvey...G 3, Albany
Mammath, John...Ashby-de-la-Zouch, Leicestersh.
†Manchester, Duke of....Kimbolton Castle, Kimbolton, Hunts
Manclarke, R. B...Warslow Hall, near Ashbourne, Derbyshire
†Mangles, F., M.P..Down Farm, Compton, Guildford, Surrey
Manley, John Shawe...Manley Hall, Lichfield
Mann, John...Thornage, Dereham, Norfolk
Mann, John...Fenstanton, Saint Ives, Hunts.
Manners, Lord Charles, M.P.... Belvoir Castle, Leicestershire
Manning, Fred....Byron House, Leamington
Manning, Henry...251, High Holborn
Manning, John...Harpole, Northamptonshire
Mannings, George...Downton, Salisbury, Wiltshire
Mansel, John Clavel...Whatcombe House, Blandford, Dorset
Mansel, Lieut.-Col.....Smedmore, Corfe Castle, Dorset
Mansel, Raleigh A...Heathfield, Swansea, S.W.
Mansel, Thomas...Pembroke
†Mansell, Sir John, Bart....Llanstephan Cottage, near Carmarthen
Mansell, Thomas...Adcott Hall, near Shrewsbury
Mansfield, Earl of...Scone Palace, Perth, N.B.
†March, Earl of, M.P.... Chichester, Sussex
Marchant, George...Titsey Court, Godstone, Surrey
Marden, William...Gerpens, Rainham, Essex
†Margetts, Charles...Huntingdon
Marindin, Rev. Sam....Shanks House, Wincanton, Somersetshire
Marjoribanks, D. C....Bushey Hall Farm, Watford
†Marjoribanks, Edward, jun....
†Marjoribanks, Stewart, M.P....Bushy Grove, near Watford, Hertfordshire
Markby, John R....Middleton, Yoxford, Suffolk
†Markham, Charles, jun....Northampton.
Markham, Rev. Rice...Morland, Penrith
Marks, Richard...Quainton, Aylesbury
Marmont, James...Bristol
Marr, William...Yarm, Yorkshire
Marryatt, Frank...Langham Manor, Norfolk
†Marshall, Arthur...Headingley, Leeds
Marshall, Francis... Grimstone Cottage, Wolverhampton, Staffs.
†Marshall, James Garth...Headingley, near Leeds
Marshall, John...Eden Lodge, Beckenham, Kent
Marshall, John...Alnham, Whittingham, Alnwick
Marshall, John...Riseholme Lodge, near Lincoln
Marshall, Joseph...Ashgrove, Halifax, Yorksh.
Marshall, Jos...Waldersea House, Wisbeach, Camb.
Marshall, Rev. T...Eccleston, near Chorley, Lanc.
Marshall, William...Bolney, Brighton, Sussex
Marsham, Charles W....Stratton Strawless, near Norwich
Marsham, Rob. (D.C.L.)...Merton College, Oxford
Marsham, Rob...Stratton Strawless, near Norwich
Marsland, Major Thos...Henbury Hall, Macclesfield
Marston, Francis...Wigley, near Ludlow, Shropshire
Martin, Chas. Wykeham, M.P...Leeds Castle, Maidstone, Kent
Martin, David...Wainfleet, Spilsby, Lincolnshire
†Martin, Fran. P. B...Kingston House, Dorchester, Dorset
Martin, Henry...Littleport, Ely, Cambridgeshire
Martin, H. B...Colston Basset, Bingham, Notts.
Martin, John...Evershot, Dorset
Martin, John William...Shoborough, Tewkesbury
Martin, Peter...Chilham, Canterbury
Martin, Robert...Asterby, Horncastle, Lincolnshire
Martin, Capt. Thos., R.N....Montpellier Lodge, Brighton
Martin, Thomas...Hextle House, East Peckham, Tonbridge, Kent
Martin, Wm...Scamblesby, Horncastle, Linc.
Martin, Wm...Bixley Hall, Norwich
Martin, W. B...Westborough, Barnsley, Yorkshire
Martinson, Ed...Hedgfield, Newcastle-on-Tyne
†Mason, C. A...Farrington, Ledbury, Herefordshire
Mason, Mathew...Baddow, Chelmsford, Essex
Mason, Richard...Pound, Leominster, Herefordsh.
Mason, Thos..Pallinsburn Cottage, Coldstream, N.B.

Mason, Col. Wm...Necton Hall, Swaffham, Norfolk
Mason, Wright...Northolme, Boston, Lincolnshire
Massey, Alfred...Market Downham, Norfolk
Massey, Wm...Watton, Norfolk
Master, Chas. Legh Hoskins...
Master, Colonel Wm. Chester...Knole Park, near Bristol
Master, Col. Thos. William Chester...The Abbey, Cirencester
Masterman, Thos. J...Little Danby, Northallerton, Yorkshire
Masterson, James ... Collingbourn Ducis, Marlborough, Wiltshire
Matcham, Geo...New House, Downton, Wilts
Matchett, Wm...Norwich
†Matheson, Jas., M.P...The Lewes Island, N.B.
Mathew, Nath...Wern, Tremadoc, Carnarvonshire
†Mathews, Jeremiah...Park Hall, Kidderminster, Worcestershire
Mathias, W...Llambed, near Fishguard, Pembrokeshire
Maton, L. Pitt...Maddington, near Devizes, Wilts.
Matson, Edw., jun...Star Hill, Rochester
Matson, Henry...Wingham, Kent
Matson, John...Eastchurch, Queenborough, Kent
Matson, Robert...Wingham, Kent
Matson, Wm...St. Osyth, Colchester, Essex
Matthews, Frank...Glyn Moore, Isle of Man
Matthews, Rich. Wm...Beamish, Chester-le-Street
Maud, Charles T...Sydney Place, Bath, Somerset
Maughan, John...Durleigh House, Marlborough
Maughan, John...Dudley, Worcestershire
Mauleverer, Wm....Arncliffe Hall, Cleveland by Thirsk, Yorkshire
Maunsell, Thos. P., M.P...Thorpe Malsor, Kettering, Northamptonshire
Maurice, R. M. Bonnor...Bodynfol, Oswestry
Maw, Hy. Lister...Tetley, near Crowle, Lincolnshire
Maw, Mat....Cleatham, Kirton-in-Lindsey, Lincolnshire
Maxwell, M. C....Terregles, Kirkcudbrightshire, N. B.
†Maxwell, Wm. C. . Everingham Park, Pocklington, Yorkshire
May, Chas...Ipswich, Suffolk
Maybery, Walter...Brecon
Mayes, Charles Hoveton...Coltishall, Norwich
Mayhew, Joshua...Holly Cottage, Ridge Road, Botany Bay, Enfield
Maynard, Anthony Lax...Marton-le-Moor, Ripon, Yorkshire
Meade, Hon. Gen...48, Bryanston Square
Meadows, Rev. John Brewster...Witnesham, near Ipswich
Mechi, John Joseph. .4, Leadenhall Street, London
†Medlycott, Sir Wm. Coles, Bart....Milborne Port, Wincanton, Somersetshire
Meire, J., jun...Uckington, Shrewsbury
Meire, Samuel ... Berrington, Shrewsbury
Meire, T. L ..Cound Arbor, Shrewsbury
Mellor, James...Hunter Street, Liverpool
Mellows, William...Carburton, Worksop
Melville, Hon. A. L...Branston Hall, near Lincoln
†Mercer, James...13, Monkgate, York
†Mercer, William...Newton, near Warrington
Mercer, William..Grove House, Hunton, Maidstone
Meredith, Lewis...Shrewsbury
Merest, Charles W...The Priory, Fornham, Bury St. Edmunds
Merrifield, Thomas S...Wainfleet, Lincolnshire
†Merriman, Thomas B...Marlborough
†Merriman, Wm. Clark...Lockeridge, Marlborough
†Mertens, Baron Edw...Rue Ducale, Brussels
†Metcalfe, Chas. James, jun....Chawson House, near St. Neot's, Huntingdonshire
Meux, Sir Henry, Bart...Theobald's Park, Waltham Cross, Essex
†Meyer, James...Forty Hall, Enfield, Middlesex
Meyer, Ph. Herman..Forty Hall, Enfield, Middlesex
Meyrick, Edward...Windsor
Meyrick, Owen Fuller...Bodergan, Anglesey, N.W.
Michelmore, Thos., jun...Berry House, Totnes
Mickleburgh, Charles...Montgomery
Micklethwait, Sir Peckham, Bart....Iridge Place, Hurst Green, Sussex
Middleton, Jno...Sparham, near Reepham, Norfolk
Midgley, Thos...Buersill, Rochdale, Lancashire
Milburn, John...Crawcrook, Ryton, Newcastle-on-Tyne
Miles, John...Wexcombe, Great Bedwin, Wilts.
†Miles, John William...Leigh Court, Bristol
†Miles, Grosvenor...Chessington Lodge, Kingston, Surrey
†Miles, P. W. S., M.P....Leigh Court, Bristol
Miles, Roger Dutton...Keyham, Leicester
Miles, Thos...Keyham, near Leicester
Miles, Wm. Marsh...Fragham, Wingham, Kent
Milford, Lord...Picton Castle, Haverfordwest
Milhouse, Wm....Barwell Hall, near Hinckley
Mill, Sir Jno. Barker, Bart...Mottisfont Abbey, near Romsey, Hants
†Miller, Bartlett...Moulton, near Northampton
Miller, Giles...Goudhurst, near Lamberhurst, Kent
Miller, John, jun...Morfa Maur, Aberystwith
Miller, Rev. M. H...Hopton, Lowestoft
Miller, Thos...Castle Farm, Sherborne, Dorsetshire
Miller, T. B...Thorpe Villa, Loughborough, Leices.
Millett, Charles...19, Brunswick Terrace, Brighton
Mills, John...Castle Gate, Nottingham
Mills, John...Burford, Oxon
Mills, John...Bisterne, Ringwood, Hampshire
Mills, Wm...Saxham Hall, Bury St. Edmunds, Suff.
†Milne, Alex...1, Whitehall
Milne, David...120, Pall-Mall
Milne, E. W....Pit Farm, Cartmel, near Milnthorp
Milne, O., jun...Prestwich Wood, near Manchester
Milner, Sir Wm., Bart....Nunappleton, Tadcaster, Yorkshire
Milner, Wm...Nunappleton, Tadcaster, Yorkshire
Milnes, Jas...Alton Manor, near Wirksworth, Derbyshire
Milnes, R. Monckton, M.P....Fryston Hall, Pontefract, Yorkshire
Milnes, William...Stubbinedge Hall, near Chesterfield, Derbyshire

Minett, Chas. Wm...41, West Smithfield
Minor, John Bishton...Astley House, Shrewsbury
Mitchell, John...Wymondham, Norfolk
Mitchell, John Hoffe...Dean's Leaze, Witchampton, Wimborne
†Mitford, Wm. Townley...Pitshill, Petworth, Sussex
Mold, Chas. John...Makney, Duffield, near Derby
†Molesworth, Sir Wm., Bart.... Pencarrow, near Bodmin, Cornwall
Molyneux, J. M...Loseley Park, Guildford, Surrey
Monck, J. Bligh... Coley Park, Reading, Berkshire
Monckton, Geo...Stretton, Wolverhampton, Staffs.
Monk, C. A...Wylam, Oakwood, Newcastle-on-Tyne
Monkhouse, John...The Stowe, near Hereford
Monins, John...Ringwould, near Dover, Kent
Monson, Rev. John...Rectory, Bedale
†Monteagle, Lord...Mount Trenchard, Limerick, Ireland
Montgomery, James...Lillington, Leamington
Montgomery, Rev. Robt....Holcot, Northampton
Moody, C. A., M.P...Kingsdon, Yeovil, Somerset
Moody, Capt. R. C...Junior United Service Club
†Moore, Rev. E...Frittenden, Staplehurst, Kent
Moore, Edw. Wells...Coleshill, Faringdon, Berks.
Moore, George...Appleby Hall, Ashby-de-la-Zouch, Leicestershire
Moore, Rev. G. B...Tunstall, Sittingbourne, Kent
†Moore, H...Redbourn, Kirton-in-Lindsey, Lincsh.
Moore, James...Shrewsbury
Moore, John...Church Street, Warwick
Moore, John...Moor House, by Ackworth, Wakefield, Yorkshire
Moore, John...Appleby, Ashby-de-la-Zouch, Leic.
Moore, John Kirby...Badley, Stowmarket, Suffolk
Moore, Robert C...Harmslow, near Lincoln
Moore, Thomas...Barkby, near Leicester
Moore, Thomas...Ruddington, near Nottingham
Moore, Thomas, jun...Shelford, Braintree, Essex
Moore, Thos. Sewell...Warham, Wells, Norfolk
Moore, Wm.,. Elm, Wisbeach, Cambridgeshire
Morant, George...Holme, Wareham
Morant, John... Brocklehurst, near Lymington, Hants
Mordaunt, Rev. C...Badgworth Rectory, near Cross, Somersetshire
Morewood, Col. W. P...Alfreton Park, Derbyshire
Morgan, Charles...Llanrhidian, Gower, S. W.
Morgan, Sir C. M. R., Bart., M.P...Rapona Castle, Glamorganshire
Morgan, Francis...51, Bedford Square
Morgan, Henry...King Street, Norwich
Morgan, John B...King Street, Norwich
Morgan, Robert...41, West Smithfield
Morgan, Wm...Brampton Park, near Huntingdon
Morison, Alex. J., M.D...Portcleu, near Pembroke
Morland, George Bowes...Abingdon, Berkshire
Morland, Wm. C...Pickhurst, Bromley, Kent
Morle, Thomas B...Cannington Park, Bridgewater
Morley, Benjamin...Snenton, near Nottingham
Morley, Earl of...Saltram, Plympton, Devonshire
†Morley, John...
Morley, Richard...Snenton, near Nottingham
Morrell, Frederick J.. Oxford
Morris, Clarke...Oakham Grange, Rutlandshire
Morris, George...Gosfield, Halstead, Essex
Morris, George Byng...Sketty Park, Swansea
Morris, Henry.. Gosberton, Spalding, Lincolnshire
Morris, Henry...Maidstone
Morris, Lewis...Mount Pleasant, near Carmarthen
Morris, Philip...The Hurst, Ludlow
Morris, Robert M....Seafield House, North Sunderland, Northumberland
Morris, Thomas...Llanvillo, Brecon
Morris, William...Carmarthen
Morriss, Charles C...Loddington Hall, Uppingham, Rutlandshire
Morriss, Nicholas...Blue House, Washington, Gateshead
Morton, James... Parham, Storrington, Sussex
Morton, J. C...Whitfield, near Berkeley, Gloucestershire
†Morton, John D...Lower Wick, near Worcester
Moseley, Chas...New Barns, Ely, Cambridgeshire
Mosley, A. N. E...Burnaston House, near Derby
Mosley, Sir Oswald, Bart...Rolleston Hall, Burton-on-Trent, Staffordshire
Mosley, Tonman...East Lodge, Burton-on-Trent, Staffs.
Moss, Francis...Whiston Hall, near Rotherham, Yorkshire
Moss, John...Liverpool
Moss, Joseph...Aughton, near Rotherham
Mossop, John...Moulton Marsh, Spalding, Linc.
Mostyn, Sir P., Bart...Talacre, Holywell, Flint
Mott, J. T...Barningham Hall, Aylsham, Norfolk
Mott, William...Wall, Lichfield, Staffordshire
Moult, Wm...Knowsley, Prescot, Lancashire
Mount Edgecumbe, Earl of...Mount Edgecumbe, Devonport
Mount, Thomas...Saltwood, Hythe, Kent
Mount, Wm...Wasing Place, Newbury, Berks.
Mountford, Geo...Pentrehyling, Churchstoke, Salop
Mousley, Isaac...Sandwell, near Birmingham
Muggeridge, Henry...St. Andrew's Hill, City
Mumford, Geo...Bricett Hall, Bildestone, Suffolk
Mumford, Geo...Cockfield, Stowmarket
Mumford, Geo...Little Cornard, Sudbury, Suffolk
Mundy, William...Markeaton, near Derby
Munn, Fred....Temple Langham, St. John's, near Worcester
Munn, Wm. Augustus...Throwley House, near Faversham, Kent
Murdoch, James Gordon...11, Haymarket
Murrell, Gibbs Howes...Lesingham House, Surlingham, Norwich
Murrell, Thos. R....Potter Heigham, Ludham, Norwich
Murton, John...Cooling Castle, Rochester, Kent
Murton, Wm...Tunstall, Sittingbourne, Kent
Muscott, John..Westonbury, near Pembridge, Herefordshire
†Musgrave, Sir G....Edenhall, Penrith, Cumberland
Muskett, Alfred...Raynham, Fakenham, Norfolk
Muskett, Chas....Bressingham House, Diss, Norfolk
Muskett, John...Fornham, Bury St. Edmunds, Suff.
Musters, John...Annesley Hall, Nottingham

Mytton, Rev. D. F. Glynn....Llandyssill, near Montgomery
Mytton, Thos...Shipton Hall, Much Wenlock, Salop

Nainby, Richard...Barnolby-le-beck, near Grimsby, Lincolnshire
Nairn, Philip...Waren, Belford, Northumberland
Naish, W. B....Stoneaston, near Wells, Somerset
Nalder, J. H....Alvescot, Lechlade
†Napier, Edw. B...Pennard House, Shepton Mallet
Napper, John...Ifold, Petworth, Sussex
Nash, Charles...Royston, Hertfordshire
Nash, Daniel...60, Strand
Nash, James...Chesham, Buckinghamshire
Nash, Joseph...Reigate, Surrey
Nash, Thomas F.....Manor House, Great Chesterford, Essex
Nash, Wedd William...Denmark Hill, Surrey
Naylor, John...Liverpool
Neale, Charles...Mansfield Woodhouse, Notts
Neame, Charles...Faversham, Kent
Neame, Frederick...Preston, near Faversham, Kent
Neave, Richard Digby...Pitt House, Epsom
Neave, Sheffield...38, Old Bond Street
Neems, John...Frocester, Stroud, Gloucestershire
†Neild, William...Mayfield, Manchester
Neilson, Robert...Halewood, Rotunda Club, Liverpool
Nelson, John...Highford, Sheffield
Nelson, Rev. John... Sparsholt House, Wantage, Berks.
Nesbit, John C....38, Kennington Lane, Lambeth
Nethercoat, John...Moulton Grange, Northampton
Neve, John...Tenterden, Kent
Neve, Thomas...Benenden, Cranbrook, Kent
†Nevile, Rev. Christ....Thorney, Newark, Notts.
Nevill, R. J....Llangennech Park, near Swansea, Carmarthenshire
Neville, Ralph, M.P....15, St. James's Place
Newbatt, Ed....Old Place, Sleaford, Lincolnshire
Newbery, Charles...Godstone, Surrey
†Newbery, Richard P....Kimmeridge, Corfe Castle, Dorset
†Newburgh, Earl of....Hassop Hall, Bakewell, Derbyshire
Newby, Henry...Hall Garth, near Durham
Newdegate, C. N....Arbury, Coventry, Warwickshire
Newdigate, Francis...Blackheath, Kent
Newill, Joseph...Walcot, Bishop's Castle, Salop
Newill, Thomas...Spring Bank, Welshpool, Montgomeryshire
Newington, Dr. S....Knole Park, Frant, Tonbridge Wells
Newman, Chas....Court Farm, Hayes, Uxbridge
Newman, Jacob...Eastcott, Devizes, Wiltshire
†Newman, John...Brands House, High Wycombe, Buckinghamshire
Newman, Joshua...Bayford Hall, near Hertford
Newman, Matthew...Hayes Court, Hayes, Uxbridge
Newman, Thomas...Mamhead, near Exeter, Devonshire
Newman, Wm....Darley Hall, Barnesley, Yorkshire
Newstead, Thomas, jun....Dunham, Newton, near Retford, Nottinghamshire
Newton, Rowley Bradley...Brunswick Street, Macclesfield, Cheshire
Newton, Marcellus...Warham, near Hereford
Newton, Thomas F....Dogdean, Wiltshire
Newton, William...The Close, Norwich
Niblett, D. J....Haresfield Court, near Gloucester
Nice, Thomas...Great Bradley Hall, Newmarket
†Nicholl, The Right Hon. John...Merthyr Mawr, Glamorganshire
Nicholls, George...17, Hyde Park Street
Nicholls, John S....Melplash Court, Bridport
Nicholson, Calvert...Bunny, near Nottingham
Nicholson, Charles...Staniwells, Brigg, Lincs.
Nicholson, E. A....Burford St. Martin, Salisbury, Wiltshire
†Nicholson, Geo. T....Waverley Abbey, Farnham, Surrey
Nicholson, Henry...Broughton Vale, Brigg, Lincs.
Nicholson, Henry...Peterborough
Nicholson, John...Shotley Bridge, Durham
Nicholson, John...Kirkby Thore, Bridgend, Appleby
Nicholson, Samuel...Waverley Abbey, Farnham, Surrey
Nicholson, Thomas...Grayingham Grange, Kirton-in-Lindsey, Lincolnshire
Nicholson, William Nurzam...Newark-upon-Trent
Nickisson, John...Stone, Staffordshire
Nicklin, Richard...Glen Ville, Douglas, Isle of Man
Nicol, James Dyce...5, Hyde-Park Terrace
Nightingale, Peter...Worsley, near Manchester
†Nightingale, W. E....Embley, near Romsey Hants
Nixon, William...Kirkdale, near Liverpool
Nixon, William...Union Hall, Newcastle-on-Tyne
Nock, John...Kinver, Stourbridge, Worcestershire
Nockolds, J. A....Stanstead, Essex
Nockolds, Martin...Saffron Walden, Essex
Nodder, Rev. Joseph...Ashover Rectory, Chesterfield, Derbyshire
Noel, Charles...Peckleton Farm House, Hinckley
Noel, Chas....Bell Hall, Bromsgrove, Worcestershire
Norman, George...Goadby Marwood, near Melton Mowbray
†Norman, George Warde...Bromley, Kent
Norman, J. M....Dencombe, Crawley, Sussex
Norreys, Robert Henry...Davy Hulme Hall, near Manchester
Norris, Rev. Geo. Poole...Roscraddock House, St. Cleare's, Liskeard
†Norris, Wm....Woodnorton, Fakenham, Norfolk
Norris, W. John...Clifton Wood House, Bristol
North, Chas....South Thoresby, Spilsby, Lincolnsh.
North, Frederick...Rougham, Swaffham, Norfolk
North, Lieut.-Col....Wroxton Abbey, Banbury, Oxon
North, Nicholas...Wiggenhall, St. Mary Magdalen, near Lynn, Norfolk
Northcote, Henry Stafford...Pines, Exeter, Devon

Northeast, T. B....Tedworth, Marlborough, Wiltshire
Northey, Edward Richard...Epsom, Surrey
Norton. William Fletcher Norton...Elton Manor, Bingham, Notts
Noyes, J. W. F....Laverstock Hall, Salisbury
Noyes, Thomas H.....East Marscalls, Lindfield, near Cuckfield, Sussex
Nunn, E. C....Diss, Norfolk
Nurse, W. M...Great Cell Barns, St. Alban's, Herts.

Oakden, John...Waresby, Caxton, Cambridgeshire
Oakes, T. H...Riddings House, Alfreton, Derbysh.
Oakley, John...Darland, Chatham, Kent
Oakley, John...182, Piccadilly
Oatley, W. H...Wroxeter, Shrewsbury, Shropshire
O'Brien, Stafford...Blatherwycke Park, near Wansford
Odams, James...Bishop's Stortford, Hertfordshire
Ogden, John Biss...Bury Hill, Coldstream, N. B.
†Ogden, John Maude...Sunderland
Ogilvie, George S...Stapleton Court, Bristol
Ogilvy, Hon. Col. Donald....Balnaboth House, Kirriemuir, N. B.
Ogilvy, Sir John, Bart....Baldovan House, near Dundee, N.B.
Ogle, Charles... Newcastle-on-Tyne
Okes, John... Cherry Hinton, Cambridge
Oliver, Francis...Dorchester, Dorsetshire
Oliver, James...Hanford, Blandford, Dorsetshire
†Oliver, John...Abingdon, Berkshire
†Oliverson, Richard...14, Portland Place
Onions, John...Broseley, Shropshire
Onslow, Rev. Chas...Church Knowle, Wareham, Dorset
Onslow, Phipps V...Suckley, Worcester
Ord, William., M.P...Whitfield Hall, Hexham, Northumberland
Orde, Charles W...Nunnykirk, Morpeth
Orde, Rev. John...Winslade Rectory, Basingstoke, Hants
Orford, Earl of...Wolterton Park, Aylsham, Norf.
Orlebar, R. Lonquet...Hinwicke House, Wellingborough, Northamptonshire
Ormerod, George...Fern Hill, near Rochdale, Lancashire
Ormerod, George, D.C.L., F.R.S., F.S.A...Sedbury Park, Chepstow
Ormerod, Archdeacon Thos. J...Ridenhall Rectory, Harleston, Norfolk
Ormston, John...Cumberland Row, Newcastle-on-Tyne
Ormston, Robert...Newcastle-on-Tyne
Orton, Francis...Bottisford, near Nottingham
Osborn, Charles...Fareham, Hampshire
Osborn, Geo...Manor House, Pattishall, near Towcester
Osborn, George...Waterloo Terrace, Northampton
Osborn, Thomas...Market Square, Northampton
Osborne, Geo...Court Farm, Elberton, near Thornbury, Gloucestershire
Osborne, James...Maids Moreton, Buckingham
Osborne, William...Stockholt Farm, Akeley, Bucks.
Oswald, Thomas...Storrs, Windermere
†Otrante, Count Athanase...Nygard, Söderköping, Sweden
Overend, Wilson...Sheffield
Overman, C. E...4, Queen's Road, Regent's Park
Overman, Hen...Weasenham, Fakenham, Norfolk
Overman, Henry R... Weasenham, Fakenham
Overman, John R....Burnham Sutton, Burnham Westgate, Norfolk
†Overman, Robert, Burnham Market, Norfolk
Overman, T. W...Flamstead, near Redbourn, Herts
Owen, E. W. S...Condover, Shrewsbury, Salop
Owen, Henry...Worksop, Nottinghamshire
Owen, John...Lynn, near Shenstone, Staffordshire
Owen, John D...Broadway Hall, Shrewsbury
Owen, Rich...Baddiley Cottage, Nantwich, Cheshire
Owen, William...Blesington, Ireland
Owen, Wm...Woodhouse, Oswestry, Shropshire
Oxford, Bishop of...Cuddesden, Oxon

†Packe, Rev. Augustus...Walton Rectory, Loughborough, Leicestershire
†Packe, G. H...Caythorpe Hall, Grantham, Linc.
Packe, Col. H...Twyford Hall, Guist, Norfolk
†Packe, Dr. James...Mildenhall, Suffolk
Padwick, Fred...West Thorney, Emsworth, Hants
Padwick, Wm...Manor House, Hayling, Havant
Padwick, Wm. Frederick...Manor House, Hayling, Havant, Hants
Page, Robert...Sidmouth, Devon
Page, Rob. jun...Bawburgh Lodge, Norwich
Page, Thomas...Ely, Cambridgeshire
Paget, Charles...Ruddington Grange, near Notts.
Paget, E. Arthur...Thorpe, near Leicester
Paget, G. B...Sutton Bonington, Kegworth, Leicestershire
Paget, Henry...Birstal, near Leicester
Pain, George...Salisbury
Pain, Joseph...Felmersham, near Bedford
Pain, Philip..Boughton House, Kettering, Northamptonshire
Paine, John Denton...Risby, Bury St. Edmunds
†Paine, John Manwaring...Farnham, Surrey
Palgrave, Charles Frederick...Bedford
Palin, John...Christleton, near Chester
†Palin, Wm...Stapleford Hall, near Chester
Palmer, Arth...Briningham Lodge, East Dereham
†Palmer, Sir Geo. J., Bart...Wanlip Hall, Leicester
Palmer, John...Stockton-on-Tees
Palmer, Sir John H. Bart...Carlton Park, Rockingham, Northamptonshire
†Palmer, Rev. Philip H. ... Wolsthorp Rectory, Grantham, Lincolnshire
Palmer, Wm.. Green Lane, Feckenham, Worcestershire
Palmer, William James...The Close, Lichfield
†Palmerston, Viscount, M.P...Broadlands, Romsey, Hants
Pank, John...Oxney, Peterborough, Northamptonshire
Pantin, James Henry...Westcote Rectory, Stow-on-the-Wold, Gloucestershire
Papendick, Bridget Ann...Glasbury House, Glasbury, Radnorshire

Papillon, Thos....15, Marlborough Buildings, Bath
Pardoe, Rev. George...Hopton Castle, Ludlow
Pardoe, James...Sion Hill, Kidderminster
Pares, Thomas...Hopwell Hall, near Derby
Park, Philip...Preston, Lancashire
†Parker, Chas. S...Annesley, Liverpool
Parker, George...Bexley, Norwich
Parker, Sir Hyde, Bart...Melford Hall, Long Melford, Suffolk
Parker, J. Oxley...Woodham Mortimer Place, Maldon, Essex
Parker, K. S., Q.C...13, New Square, Lincoln's Inn
Parker, Rev. R...Welton, near Spilsby, Lincolnsh.
Parker, Samuel...Newcastle-on-Tyne
Parker, Thos. H...Park Hall, near Longton, Staffs.
Parker, Thos. T...Sutton Grange, St. Helen's, Lancashire
Parker, Viscount....Sherburn Castle, Tetsworth, Oxon
†Parker, William...Yanwath Hall, near Penrith, Cumberland
Parker, Wm...Skirwith Abbey, Penrith, Cumberld.
Parker, Wm...The Park, Ware, Hertfordshire
Parker, Capt. W...Clopton Hall, Woolpit, Suffolk
Parker, Rev. William...Rectory, Little Comberton, Pershore, Worcestershire
Parker, Rev. W. H...Soham Rectory, Watton, Norf.
Parkins, Edw...Chesfield Lodge, Stevenage, Herts.
Parkinson, Capt. Chas. Aug...Sunny Bank, Crickhowell, Brecknockshire
Parkinson, John...Leyfields, Newark, Notts.
Parkinson, John ..66, Lincoln's Inn Fields
†Parkinson, John, jun....Hexgreave Park, Southwell, Notts.
†Parkinson, Thomas...Thurgarton Priory, Southwell, Notts.
†Parkyns, Thomas G. A....Ruddington, near Nottingham
Parmeter, Robert W...Aylsham, Norfolk
Parr, Thos...Grappenhall, Heyes, Warrington, Lanc.
Parr, Thos. Cart..Cossington, near Leicester
Parris, Jno...Farnham, near Bishop's Stortford, Herts
Parrott, Jasper...Dundridge, Totnes, Devonshire
Parrott, Thos...Green Bank, Sutton, Macclesfield, Cheshire
Parry, Nicholas...Little Haddam, Ware, Herts
Parson, George John...Haslemere, Surrey
Parson, Rev. W. H....Lynchmere, Lephook, Hants
†Parsons, George...West Lambrook, South Petherton, Somersetshire
Parsons, John...Oxford
Parsons, Wm., jun...Wilnecot, Tamworth, Staffs.
Partridge, Henry Samuel...Hockham Hall, East Harling, Norfolk
Partridge, John...Bishop's Wood, near Ross, Herefordshire
Partridge, Rev. John Anthony...Baconsthorpe, near Holt, Norfolk
Partridge, Thos...Dilbridge Farm, Colchester
Partridge, H. C....Hockham Hall, East Harling, Norfolk
Partridge, Rev. William Edw....Horsenden House, Tring, Herts
Patchett, Rev. W. H...Dishforth, Thirsk
†Paterson, Geo...Poyle House, Colnbrook, Bucks.
Patrick, Jarman...Wiggenhall St. Germans, Lynn
Patterson, John...Holbeck, Ulverston, Lancashire
†Patterson, W. J...Durnford Lodge, Wimbledon, Surrey
Pattisson, Jacob...Witham, Essex
Paul, Joseph ..Thorpe Abbots, Scole, Norfolk
Paul, Walter..High Groove, Tetbury, Gloucestersh.
Paver, William...Peckfield, Ferrybridge, Yorks.
Pawlett, Thos. Edwd...Beeston, Biggleswade, Beds.
Paxton, Joseph...Chatsworth, Bakewell, Derbysh.
Paxton, Robert....Woolaston Farm, Hethe, near Bicester, Oxon
Paxton, Thomas...Potsgrove, Woburn, Beds.
Paxton, Wm...Langford Farm, Bicester, Oxon
Payne, William...Willcott, Shrewsbury, Salop
Paynter, Thos...Boskenna, Cornwall
Peacey, Robert...Chedgelow, Tetbury
Peachey, Wm...Ebernoe, near Petworth, Sussex
Peacock, A...South Ranceby, Sleaford, Lincolnsh.
Peacock, Thos...Bishop's Auckland, Durham
Peacock, Wilkinson..Thorpe Tilney, Sleaford, Lincolnshire
Peake, Samuel...Silverdale, Newcastle, Staffs.
Pearce, R. M...Hill Farm, Hook Norton, Banbury, Oxon
Pearce, Samuel...Ruislip Manor Farm, Uxbridge, Middlesex
Pearce, William...Poole, Dorset
Pearce, Col. Wm...Ffrwdgrech, near Brecon
Pearce, William..10, Whitehall-Place
Pearman, Luke....Mercote Hall, Berkswell, Coventry, Warwickshire
Pearse, George...Harlington, Dunstable, Beds.
†Pearse, Henry...Digswell House, Welwyn, Herts
Pearse, J. G...Southmolton
Pearse, Thomas...Launceston, Cornwall
Pearson, Wm...Husband's Bosworth Grange, near Welford, Northamptonshire
Pedder, Edw...Clifton Hall, Preston, Lancashire
Peel, Edmund...Bonehill House, Tamworth, Staffs.
Peel, Henry...Aylesmore House, near Chepstow, Monmouthshire
†Peel, Jonathan, M.P...Accrington House, Accrington, Lancashire
Peel, Right Hon. W. Y...Bonehill, Fazeley, Staffs.
Peel, Wm...Taliaris Park, Llandillo, S.W.
Peele, R...Long Sutton, Lincolnshire
Peers, Chas...Chislehampton, Bensington, Oxon
Peers, Joseph...Ruthin, Denbighshire
Peirson, John...Thornton Fields, Guisborough
†Pell, Albert...5, Albert Row, Gloucester Gate, Regent's Park
Pell, Edwin...Sywell Hall, near Northampton
Pell, Jens...The College, Winchester, Hants
Pell, P. F...Tupholme Hall, near Wragby, Lincs.
†Pell, Sir W. O...Royal Hospital, Greenwich
Pellatt, Apsley...Knowle Green, Staines
Pellew, Hon. and Very Rev. George, D.D...Deanery, Norwich
Pelly, Richard Wilson...Upton, Essex
Pemberton, Chr...Trumpington Street, Cambridge

†Pemberton, Rev. R. N....Millichope Park, Church Stretton, Salop
Pemberton, Walter Hamilton...Holt, Norfolk
Penfold, Chas....Croydon, Surrey
Penfold, James...Lancing, Shoreham, Sussex
Penn, Edw...Hewell, near Bromsgrove, Worcestersh.
†Penn, G. J....Stoke Park, Colnbrook, Bucks.
Pennell, H. B....Dawlish, Devon
Penrice, Rev. Chas....Plumstead, Norwich
Penrice, Thos...,Kelvrough, Swansea
Penrose, R....Clyn-y-bout, nr. Neath, Glamorgansh.
Pentland, Geo. Hy...Black Hall, Drogheda, Ireland
Penton, Thos...Middleton Farm, Long Parish, Whitchurch, Hampshire
†Peploe, Capt. Daniel Peploe...Garnston, Hereford
Peppercorne, Henry..Bradburn Park, East Malling, Maidstone, Kent
Perceval, Hon. and Rev. Chas. George...Calverton, near Stony Stratford, Bucks.
†Perceval, Chas....West Haddon, Northamptonshire
Perkins, Abraham...Westfield House, Arnesby, Lutterworth, Leicestershire
Perkins, Edw..Monknash, Cowbridge, Glamorgansh.
Perkins, Fred...Chipstead Place, Seven Oaks, Kent
Perkins, Joseph..Laughton, Market-Harbro', Leicestershire
Perkins, Matthew...Bristol
Perkins, Thomas...Willersborough Court, Ashford, Kent
Pern, Thos....Crawley, Winchester, Hampshire
Perry, J. W....Moor Hall, Harlow, Essex
Pester, Philip...Dole's Ash, near Dorchester
Peters, Daniel...College Green, Bristol
Peterson, Jos...Mangotsfield, Bristol
Peterson, T. P...Mangotsfield House, Bristol
Petley, C. C....Riverhead, Seven Oaks, Kent
Pett, Henry...Shuart St. Nicholas, Thanet, Kent
Pettat, Rev. Charles Richard..Ashe Rectory, Overton, Hants
Pettman, Robt...Morehall Cottage, Folkstone, Kent
Phelips, Chas...Briggins Park, Ware, Herts.
Phelps, J. B...Monkton, Dorchester, Dorsetshire
Phelps, Rev. H. Dampier...Snodland Rectory, West Malling, Maidstone, Kent
Phelps, Thos...Sellack Vicarage, Ross, Herefordsh.
Philipps, John Walters..Aberglasney, Llandilo, Carmarthenshire
Philips, Col. F. C...Rhual, near Mold, Flintshire
†Philips, Sir Geo., Bart...Weston House, Chipping Norton, Oxon.
†Philips, G. R., M.P....12, Hill Street, Berkeley Sq.
Philips, Mark...Snitterfield, Stratford-on-Avon
Phillimore, W. B....Newberries, St. Alban's, Herts.
Phillippo, Elisha..Tacolnestone, Wymondham
Phillipps, James..Bryngwyn, near Ross Herefordsh.
†Phillipps, R. Biddulph...Longworth, nr. Hereford
Phillipps, T. J...Landue, Launceston, Cornwall
Phillipps, Richard..Aldermaster, Newbury, Berks.
Phillips, Frederick...Downham Hall Farm, near Thetford, Norfolk
Phillips, Henry...Coventry, Warwickshire
Phillips, John...Culham, Abingdon, Berkshire
Phillips, John...Lordship Lane, Tottenham
Phillips, Rev. Jno....Ludlow, Salop
Phillips, John B..Brockton Leasows, Newport, Salop
Phillips, J. F. P....Gitcumbe, near Totnes, Devon.
Phillips, Jos. Taylor...New Lodge, Newport, Salop
Phillips, Richard...Brocton Grange, Shifnal, Salop
Phillips, Richd., jun...Brocton, near Shifnal, Salop
Phillips, Sir T., Knt....Newport, Monmouthshire
Phillips, Thos....Helmsley, near York
Phillips, Rev. Wm. J. G....Eling Vicarage, near Southampton
Phillott, E. P...Thorn Falcon, Taunton
Phippen, Robert...Badgworth Court, near Cross, Somersetshire
†Phipps, C. P...Doe Park, Liverpool
Phipps, Christopher...River, near Dover, Kent
†Phipps, John Lewis...Doe Park, Liverpool
Pickard, Henry W....Hooton Roberts, Rotherham
Pickering, Leonard...Wilcot, Witney, Oxon
Pickering, William..Beaumont Chase, Uppingham, Rutlandshire
Pickford, Thos...May Fair, Manchester
Pickin, Wm. John...Whitemoor, Ollerton, Notts.
Pierpoint, Matthew...Crow's Nest, near Worcester
†Piggott, Geo. G...Somerset House, Strand
Piggott, Simon Frazer...Fitzhall, Midhurst, Sussex
Pigott, John...Thropham, Rotherham
Pigott, Sir R., Bart....Patshill, Wolverhampton, Staffs.
Pike, Llewelly Adolphus....Chute Manor Farm, Ludgershall, Wilts.
Pilcher, Chas....Winkfield, near Bracknell, Berks.
Pilcher, Jesse...Cheriton Court, Sandgate, Kent
Pilgrim, Charles H....Bear Place, near Maidenhead
Pillans, Wm....Alnwick Castle Gardens, Northumb.
Pillans, Wm....Pott, Swaffham
Pilley, Samuel...Sudbrooke, near Lincoln
Pinckard, J. T..Handley, Towcester, Northamptonsh.
†Pinfold, Charles...77, Wimpole Street
Pink, Charles...Hambledon, Horndean, Hants
Pink, Richard...Hambledon, Horndean, Hants
Pinkerton, Thomas...Ancroft Steads, Berwick-on-Tweed
Pinkney, Rev. Dr....East Sheen, Surrey
†Pinnegar, Christopher..Rockbourn, Fordingbridge, Hants
Pinney, Wm., M.P...The Park, Somerton, Somerset.
Pipon, Major Thos...Langtons, nr. Alresford, Hants.
Pippet, William...Downside College, near Bath
Pitfield, John Eype...Symondsbury, near Bridport, Dorsetshire
Pitman, James S...Dunchidcock House, Exeter
Pitt, Geo...Stork's House, Wellington, Herefordsh.
Pix, Saml...Baron's Grange, Peasmarsh, Sussex
Pix, Thos...Woodside, Peasmarsh, Sussex
Platt, G. E..Smith's Cottage, ParkCrescent, Worthing
Platten, G...East Winch, near Lynn, Norfolk
Platten, John...King's Lynn, Norfolk
Platten, Robert...East Winch, Lynn, Norfolk
Plaxton, Rich...Cam Hall, Wanstead, Essex
Plestow, C. B...Watlington Hall, Downham, Norfolk
Plummer, Matthew...Sheriff Hill, Newcastle-on-Tyne
Plumptre, J. P., M.P....Fredville, Wingham, Kent

†Pocock, Chas...Sulham, Reading, Berkshire
Pocock, Geo...Beaumont Farm, St. Alban's, Herts.
Pocock, Henry..Curtle House, near Beaulieu, Southampton
Pocock, Richard...Hedge's Farm, St. Alban's, Herts.
Pocock, Saml..Barnes Farm, King's Langley, Herts.
Pocock, T. W...Green's Farm, Chieveley, Newbury
Pole, Peter...6, Upper Harley Street, London
Pole, Rev. Reginald C....Radbourne, near Derby
Polhill, Wm....Broadwell, Moreton-in-Marsh
Pollard, Geo. A... Brockhurst, Coventry, Warwicksh.
Pollard, Pascho, jun....Berrys, Totnes
Pollen, Sir J.W., Bart...Redenham, Andover, Hants
Pollock, John O.G...Mountain's Town, Navan, Co. Meath, Ireland
Poltimore, Lord...Poltimore, near Exeter, Devon
Pomfret, Richard Curteis...Rye, Sussex
Pomfret, Earl of...Easton Hall, Towcester
†Pomfret, Virgil...Tenterden, Kent
Poole, Domville...Marbury, Whitchurch, Salop
Poole, Rev. John...Enmore Parsonage, near Bridgewater, Somersetshire
Poole, Wm. H...Tenick Hall, Whitchurch, Salop
Pooly, Thomas...North Wold, Norfolk
Pope, Edw...Great Toller, Maiden Newton, Dorset.
Pope John...Symondsbury, Bridport, Dorset.
Pope, John...Eastwood House, March, Cambs.
Pope, William...Toller Whelme, near Beaminster, Dorsetshire
Porcher, Charles...Cliffe, Dorchester, Dorset.
Porcher, Henry ... Park Corner, Hartford Bridge, Heck, Hampshire
Porquet, M. Fenwick de...Iron Foundry, Hornchurch, Romford, Essex
Portal, Melville ... Freefolk Priors, Whitchurch, Hampshire
Porter, Lieut.-Colonel...Mintern House, Dorchester, Dorset.
Porter, Wm...Hembury Fort, Honiton, Devon.
Porter, Wm...Frieston, near Boston, Lincolnshire
Portman, Wyndham B., R.N....Hare Park, Newmarket, Cambridgeshire
Postle, Rev. Edw....Yelverton Rectory, Norwich
Potter, Addison, jun....Heaton Hall, Newcastle-on-Tyne
Potter, Edward...Chisbury, Gt. Bedwin, Wilts.
Potter, Joseph...Horsley Woodhouse, Derby
Potter, R...Lydden Court, Dover, Kent
Potter, Wm. H...28, Clapham Road Place, Kennington, Surrey
Potterton, Nathaniel...Boughton Park, near Northampton
Potterton, T. B....Clipstone, Market Harborough, Leicestershire
Potts, Forster C...Whorlton, Newcastle-on-Tyne
Potts, Timothy...Rising Sun, Long Benton, Newcastle-on-Tyne
Poulton, Wm....Head Master of the Norwich Diocesan School, Aylsham
Povey, John...The Derwen, Oswestry
†Powell, Alex...Hurdcott House, Salisbury, Wilts.
Powell, Colonel...Hardwick, Hay, Herefordshire
Powell, George...8, Beaufort Buildings, Strand
Powell, Harrison...Toft, near Cambridge
Powell, John...Watton Mount, Brecon, S. W.
Powell, John Folliot...Welwyn, Herts.
Powell, John Thos...Easton Pewsey, Wilts.
Powell, Phillips...South Lands, Denham, Uxbridge, Middlesex
†Powell, Rev. S. H...Sharon Hall, Ripon, Yorksh.
Powell, Thomas...Muckleton, Shrewsbury
Powell, Rev. Thos. John...Cantriff, near Brecon
†Powell, Colonel W. E., M.P...Nanteos, near Aberystwith, S. W.
Powell, Wm...Eglwys, Nunydd, Bridgend, Glamorganshire
Powell, William .... Tickford Abbey, Newport Pagnell, Bucks.
Powles, Thos. W...Barham Lodge, Elstree, Herts.
Pownall, Rev. C. C. B....Milton Ernest, near Bedford
†Powys, Capt. T...Westwood House, Leek, Staffs.
Poynder, Thomas...52, Wimpole Street
Pratt, Edw....Caldwell, Burton-on-Trent, Staffs.
Pratt, Edw. B....Sedlescombe, Battle, Sussex
†Prentice, Manning...High Easton, Chelmsford
Preston, Cooper...Flasby Hall, Skipton
Preston, Capt. R.N...Borde Hill, Cuckfield, Sussex
Price, Charles...Cannon Gate, Hythe, Kent
Price, Edw....Court House, Pembridge, Leominster, Herefordshire
Price, Fowler Boyd...Huntington Court, Hereford
Price, Joseph...Monmouth
Price, Wm...Benhall, near Ross, Herefordshire
Price, Wm. P...Tiberton Court, near Gloucester
Prichard, Robt....Llwydiarth Esgob, near Bangor Anglesey
Prickard, Thomas...Dderu House, Rhayader, Radnorshire
Prickett, Rev. Josiah J....Markington Parsonage, Harrogate
Priday, Samuel...Linton, near Gloucester
Pride, Thos...Llanvihangel, near Chepstow, Monmouthshire
Prideaux, Sir Edmund S., Bart....Netherton, near Honiton, Devon.
Priestley, John...Kirdrefaig, Isle of Anglesey
Priestley, S. O...Treefan, Pwllheli, Carnarvonshire
†Pritchard, George...Broseley, Salop
†Pritchard, John...Broseley, Salop
Pritchett, Wm. D....Little Hallingbury, Bishop's Stortford, Herts
Proctor, Robt...Geys House, Maidenhead
Proctor, Thomas...Cothay, Bristol
Proctor, Thos. Beauchamp...Langley Park, Loddon, Norfolk
Proctor, Sir W. B....Langley Hall, Norwich
Propert, John...Blaenpistill, Cardigan
Prower, Rev. John M...Purton, Swindon, Wilts.
Pryme, George...Westow, Huntingdon
Pryor, John Izard...Clay Hall, Stevenage, Herts.
Pryor, John...Baldock, Herts.
Pryor, Morris...Baldock, Herts.
Pryse, John B...Penylan, Meifod, Welshpool
Pryse, John P...Peithill, Aberystwith, S. W.
Pryse, Pryse, M.P....Gryerddan, Aberystwith, S.W.

Pugh, Major David...Llanerchydol, Welshpool, Montgomeryshire
Pugh, George...Coal Port, Iron Bridge, Salop
Pugh, Wm. B...Patrington, near Hull
†Pugh, Wm. ..Coal Port, Ironbridge, Salop.
Pulini, Ilario...39, Brewer Street, Golden Square
Pulleine, James...Crakehall, near Bedale, Yorksh.
†Puller, Christoph. W...Youngsbury, Ware, Herts.
Pulver, Rich.... Evenley, near Brackley, Northamptonshire
Pulver, Thomas...Broughton, Kettering, Northamptonshire
†Punnett, P. S...Chart Sutton, Maidstone, Kent
Punchard, Charles...Blunt's Hall, Haverhill, Suff.
Purchas, R. W....Pilstone, near Monmouth
Purser, Edward...40, Bridge Street, Blackfriars
Purton, Thos. P...Fairtree, Bridgenorth, Salop
Purves, Peter...Alconbury, near Huntingdon
Putland, Henry...Hurst Green, Sussex
Pyatt, Abraham...Wilford, near Nottingham
Pye, Henry A....Louth, Lincolnshire
Pyne, William.....Cradley, near Great Malvern, Worcestershire

Quartly, Jas....Molland House, South Molton, Devonshire
Quicke, Rev. Andrew...Winchester, Hampshire
Quicke, John J....Newton House, Exeter
Quinn, Peter....Newry, Ireland

Racster, William...Thingehill, near Hereford
Radcliffe, Rev. Walter...Warleigh, Plymouth, Devonshire
Radclyffe, Chas. James...Hyde House, Bere Regis, Blandford, Dorsetshire
Radford, John...Stanton House, Burton-upon-Trent, Staffordshire
†Raincock, H. D....Croydon, Surrey
Raine, W. Surtees...Weston-super-Mare, Somerset.
Ralph, Rowland...Westby, Halifax, Yorkshire
Rammell, E. Wootton...Chelsheu, near Croydon
Rammell, Thomas...Sturry Court, Canterbury
Ramsay, Geo. Heppel...Derwent Villa, Newcastle-upon-Tyne, Northumberland
Ramsay, Sir James, Bart....Banff House, Alyth, Perthshire
Ramsay, John...9, Endsleigh Street
Ramsbottom, John...Bilham Grange, Doncaster
Ramsden, Henry...Ledstone, Pontefract
Ramsden, Robert...Carlton Hall, Worksop, Notts.
Randall, John...Bridgend, Cardiff, Glamorganshire
Randall, Richard...Tunbridge Wells, Kent
Randell, Alexander...Maidstone
Randolph, Capt. C. G., R.N....St. Comp, Wrotham, Kent
Ransome, James Allen...Ipswich, Suffolk
Ransome, Robert...Ipswich, Suffolk
Raper, Henry...5, Chapel St., Grosvenor Square
Raper, Robert...Chichester, Sussex
Raphael, Lewis...Bush Hill Park, Edmonton, Middlesex
Rasbotham, Dorning ... Doddlespool, Newcastle, Staffordshire
Ratcliffe, Richard...Ingleby, near Derby
Rathbone, Theodore W...Allerton Priory, Liverpool
Ratleff, William...Newmarket, Cambridgeshire
Ravenshaw, Rev. Edward...West Kington Rectory, Chippenham
Rawes, John...Duxbury Park, Chorley, Lancashire
Rawlence, G. C...Parsonage, Fordingbridge, Hants.
Rawlence, Jas...Heale, Woodford, Salisbury, Wilts.
Rawlins, George...Lee House, Romsey, Hampshire
Rawnsley, Rev. Edward...Raithby Hall, Spilsby, Lincolnshire
Rawson, Charles...Wardale Hall, Whitehaven
Rawson, Rich...Wheathill, near Liverpool
Rawson, Thos. Sam....Bridgen Place, Bexley, Kent
Rawsthorne, Thomas...Heysham Hall, Lancaster
Ray, Henry...Bristol
Ray, John...Heanor Hall, near Derby
Ray, John...South Green, East Dereham, Norf.
†Raynbird, Hugh..Laverstoke,Andover Road,Hants
Raynbird, Robert...Hengrave, Bury St. Edmunds, Suffolk
Rayne, Chas...Carville Hall, Newcastle-upon-Tyne
Rayne, Robert...Flatt's Farm, Bishop Auckland, Durham
Rayner, Henry...Ely, Cambridgeshire
Rayner, W....Ely, Cambridgeshire
Raynes, Michael...Tent's Hill, Frome, Somerset.
Rayson, Robert...Stockton-on-Tees, Durham
Rea, Geo....North Middleton, near Wooler, Northumberland
†Read, Clare Sewell...Kilpaison, Pembroke
Read, George...Easton Hall, near Norwich
Read, John...Derwent Hall, Sheffield
Read, J. O. C....Wern, Northop, Flint
Read, Richard...35, Regent Circus, Piccadilly
Read, Robert...Crediton, Devonshire
Reade, Rev. Joseph Bancroft, M.A., F.R.S....Vicar of Stone, Aylesbury, Buckinghamshire
Redhead, John ... Walker Farm, Newcastle-upon-Tyne
Reed, John...Hopton, near Thetford, Norfolk
Reed, Nicholas Ridley...Byrness, Newcastle upon-Tyne
Reed, Thos....Warksworth Barns, Alnwick, Northumberland
Reeks, James...Standen, near Hungerford, Berks
Rees, Barton Edmund...Carlisle
Rees, John...Flinston, near Pembroke
Rees, Rees Edward...Pantriwgoch, near Newport, Monmouthshire
Rees, W. T...Holly House, Newport, Monmouthsh.
Reeve, James...Snetterton Hall, Larlingford, Norf.
Reeve, Major-Gen....Leadenham, Grantham, Linc.
Reeve, Richard...Nassington, Wansford, Northamptonshire
Reeves, John Fry...Fitzhead Court, Milverton, Somersetshire
Reeves, J. R....Huntsland, Crawley Down, Sussex
Relf, Samuel...Ryegate, Surrey
Relph, G. R. Greenhow...Turner's Hall, Cheshire
Reynolds, Joseph...131, Piccadilly
Reynolds, Dr. William...Coeddû, near Mold, Flint

Rhodes, J. Armitage...Roundbury, near Leeds, Yorkshire
Ricardo, David... Gatcombe Park, near Minchinhampton, Gloucestershire
Rice, Edward Royd, M.P...Dane Court, near Wingham, Kent
Rich, Edmund William....Didmarton, Tetbury, Gloucestershire
†Richards, Edward Priest...Cardiff, Glamorganshire
Richards, Jas...Dumbleton, Evesham, Worcestersh.
Richards, W. H.. .Lea Coombe, Axminster, Devon.
Richardson, Geo....Bridlington Quay, Yorkshire
Richardson, John...Asgarby, Horncastle, Lincolnsh.
Richardson, Sir John Stewart, Bart...Petfour Castle, Perth, N. B.
Richardson, Joseph...Woodside, Luton, Beds
Richardson, Percival...Horkston, Barton-on-Humber, Lincolnshire
Richardson, Capt. T. .Suttonhurst, Lewes, Sussex
Richardson, Thomas...Newcastle-upon-Tyne
Richardson,Thos...Brandenburgh House, Chatteris, Cambridgeshire
Richardson, William...Great Limber, near Brigg, Lincolnshire
Riches, Thos. H. Currey...Uxbridge, Middlesex
Richmond, Francis...Salford, Manchester
Richmond, George...Heighington, Darlington
Riddell, Edward...Cheeseburn Grange, Newcastle-on-Tyne
†Riddell, Sir Walter Buchanan, Bart....13, Old Square, Lincoln's Inn
Riddell, Thomas...Felton Park, Felton, Northumb.
Ridge, Thos. John...Hambledon, Horndean, Hants.
Ridgway, John...Fairlawn, Wrotham, Kent
†Ridgway, John...Cauldon Place, Shelton, Stoke-on-Trent, Staffordshire
Ridgway, Thomas...Lymm, Warrington, Lancash.
Ridley, Rev. Chas. John...University Coll. Oxford
Ridley, John... Park End, Hexham, Northumberld.
Ridley, John M...Humshaugh, Hexham, Northumberland
Ridley, William...Felstead, Chelmsford, Essex
Rigden, William...Hove Farm, near Brighton
Rigg, Robert, F.R.S....Greenford, Middlesex
Rigg, Sam...Abbey Holme, near Wigton, Cumberld.
Riley, W. F....Forest Hill, Windsor, Berks.
Ringer, John...West Harling, near East Harling, Norfolk
Rippingall, Rev. Stephen Frost...Langham, Holt, Norfolk
Rising, William...Somerton Hall, Great Yarmouth, Norfolk
Risley, Rev. W. C....Deddington, Banbury, Oxon.
†River, John...
Rivers, Lord...Rushmore Lodge, Woodyates Inn, Blandford, Dorsetshire
Rix, Benjamin...St. Matthews, Ipswich, Suffolk
Rix, Nathaniel... Bowman's Green, Ridge, near St. Albans, Herts.
Roads, John...Ashmore Farm, Middle Claydon, Bucks.
Roals, John..BrendonFarm,Wiveliscombe,Somerset.
Robarts, Abraham George...15, Lombard Street,
Robbins, Maj.-Gen. Thos. Wm....Castle Malwood, Stoney Cross, Hants
Roberts, Charles...The Quarry, near Stourbridge, Worcestershire
†Roberts, Charles...Barnstaple, Devonshire
Roberts, Edward...King's Wood, Baldock, Herts.
Roberts, John...New Hall, Rhuabon, Denbighshire
Roberts, Owen...Dinas, near Carnarvon, N. W.
Roberts, Thomas...Ivington Bury, Leominster
Robinson, Dixon....Clitheroe Castle, Clitheroe, Lancashire
Robinson, Francis..Frampton, near Boston, Lincs.
Robinson, G. Carnaby...Bridlington, Yorkshire
Robinson, George...Wolverhampton, Staffordshire
Robinson, Rev. Sir Geo. S., Bart,..Cranford, Kettering, Northamptonshire
Robinson, Jas... Huggart's Farm, Brindle, Chorley, Lancashire
Robinson, James S....Hunter's Hall, Sunderland
Robinson, John...Royal Agricultural College, Cirencester
Robinson, John...Harton, South Shields
Robinson, Rev. John..Widmerpool, nr. Nottingham
Robinson, Joseph...Tanfield, Chester-le-Street, Durham
Robinson, Richard...Eliza Street Works, Belfast
Robinson, Thomas...Castle Ashby, Northampton
Robinson, Thomas...Oxford Bank, Oxford
Robinson,Thos.TempleLow...Newport, Sunderland
Robinson, William...Bonehill, Tamworth, Staffs.
Robson, Daniel...Shipcote, Gateshead
Robson,Rev.James...Ponteland,Newcastle-on-Tyne
Robson, John...West Cherton, Newcastle-on-Tyne
Robson, John...Sunniside, Newcastle-on-Tyne
Robson, John....East Kielder, Bellingham, Northumberland
Robson, John...Whitwell Grange, Durham
Robson, Joseph...Gateshead Park, Gateshead
Robson, Richard...Howick, nr. Alnwick, Northumb.
Robson, William...Wilton, near Salisbury
†Roch, Nicholas...Paskiston, Pembroke
Rock, James John...Glastonbury, Somersetshire
†Rodd, F. H.. Trebartha Hall, Five Lanes, Cornwall
Roddam, Wm...Roddam, Wooler, Northumberland
Roddam, John J....Newtown, Stanhope, Darlington
Rodwell, Joshua..Alderton Hall, Woodbridge, Suff.
Rodwell, William...Ipswich, Suffolk
Roe, Freeman...70, Strand
Roe, Hen. R...Geaton Hall, Yealmpton, Plymouth, Devonshire
Roe, J. C....Lynmouth, Minehead, North Devon
†Roebuck, J. A....Milton, Christchurch, Hants
†Rogers, Francis...Ramsey, Isle of Man
Rogers, Hen...Stagenhoe Park, near Welwyn, Herts
Rogers, Jasper W....Nottingham Street, Dublin
Rogers, Samuel S....Douglas, Isle of Man
Rokeby, Lord...Hazlewood, King's Langley, Herts
†Rolfe, Charles F. N...Sedgeford Hall, near Lynn, Norfolk
Rolfe, John...Beaconsfield, Bucks.
Rolls, John E. W...The Hendre, near Monmouth
Romilly, Edw...Porthkerry, Cardiff, Glamorgansh.
Romney, Earl of...Maidstone, Kent

Ronalds, John...Brentford, Middlesex
Roods, Wm....Litlington, near Lewes, Sussex
Rooke, Wm. W....Woodside, Leamington
†Rooper, J. Bonfoy.. Abbotts Ripton, Hunts.
Roper, John...Keighly, Leeds
Roper, John...Foscott, near Buckingham
†Roper, Roper S. D. R.... Sedbury Park, near Richmond, Yorkshire
Roper, Samuel...Croxton, Thetford
Roper, William...Bayham, Lamberhurst, Sussex
Rosewarn, John ... Nanpuska, Gwinnear, Hayle, Cornwall
Roskruge, John, jun....Roskruge St. Anthony, Helston, Cornwall
Ross, James...Dibden, near Southampton
Ross, William...Fobdown, near Alresford, Hants
Rossmore, Lord...The Dell, Windsor, Berkshire
†Rothwell, Rich. Rainshaw...Preston, Lancashire
Round, C. G....Birch Hall, Colchester, Essex
Round, John...15, St. James's Square
†Rous, Rev. George...Laverton, Bath
†Rous, T. B....Newton St. Loe, Bath
Rous, Hon. Wm. Rufus...Worsted House, Norwich
Row, Wm. N....Cove, near Tiverton, Devonshire
Rowe, Samuel...Malpas, Cheshire
Rowe, Wm. W..Longbrook, Milton Abbots, Devon.
†Rowland, Richard ..Creslow, Aylesbury, Bucks.
Rowland, William...Water Eaton, near Oxford
Rowland, Wm...Ramsbury,near Hungerford, Berks.
Rowlandson, Thomas...Flint, North Wales
Rowley, John G...
Rowley, John Jephson...Rowthorne, Chesterfield
Royce, John...Boxted Hall, Colchester, Essex
Ruck, Lawrence ..... Pantlludw, Machynlleth, Aberystwyth
Ruddle, George ... Walton House, Tewkesbury, Gloucestershire
†Rumbold, Charles E....Preston Condover, Basingstoke, Hants
Rusbridger, Geo....Goodwood, Chichester, Sussex
Rusbridger, John...Goodwood, Chichester, Sussex
Rusbridger, Rev. J...Goodwood, Chichester, Sussex
Ruscoe, Ralph...Newport, Monmouthshire
†Rushout,Capt., M.P. (1st Life Guards)..Athenæum Club
†Russell, Lord Charles J. F...Drakeloe Lodge, Woburn, Bedfordshire
Russell, David...York
Russell, George G...Willington, Newcastle-on-Tyne
Russell, G. L. .4, Mansfield St., Cavendish Square
Russell, Thos. A...Cheshunt Park, Waltham Cross, Herts
†Russell, Sir William...Charlton Park, Cheltenham, Gloucestershire
Russen, Joseph ... Stoke Prior, Bromsgrove, Worcestershire
Rust, James...Alconbury, near Huntingdon
Rutley, Samuel...Kemsing, Sevenoaks, Kent
Rutson, Wm...Newby Wisk, Northallerton, Yorksh.
Rutzen, Baron Fred. de...Slebeck Hall, Haverford West, Pembrokeshire
Rycroft, Sir Richard H. C...Marydown Park, Basingstoke, Hants
Ryder, Hon. Granville Dudley..Westbrook, Hemel Hempstead, Herts
Ryland, George...New Canal Street, Birmingham
Rylatt, W...Branswell, Sleaford, Lincolnshire
Sabin, John...Harbury, Southam, Warwickshire
Sadler, Henry...Mid-Lavant, Chichester, Sussex
Sadler, William J...Purton, Swindon, Wilts.
Sage, Edward...Furze House, Romford, Essex
Sainsbury, William...Manor House, West Lavington, Devizes, Wiltshire
St. Aubyn, Rev. Hender Molesworth...Clowance, Camborne, Cornwall
St. John, Lord...Melchbourne, Higham Ferrers
St. Vincent, Viscount...Meaford, Stone, Staffs.
Salisbury, Edw. D...Middleton Tower, Lancaster
Sallit, Matthew...Saxlingham, Norwich
Sallows, Henry...Semer Dairy, Hadleigh, Suffolk
Salmon,Perridge..LuffieldAbbey,near Stowe, Bucks.
Salmon, Richard...Watton, Norfolk
Salmon, William...Park Fields, near Stowe, Bucks.
Salomons, David ...Broom Hill, Tonbridge, Kent
Salter, Geo...Combe Farm, Crewkerne, Somerset.
Salter, W. P....Whinberg, East Dereham, Norfolk
Salter, W. P., jun....Cottessey Lodge, Norwich
Salusbury, Rev. Thelwell J. T....Offley, near Hitchin, Herts
†Salvin, Marmaduke Chas...Burnhall, near Durham
Samman,Wm..Middleton Park, near Bicester, Oxon
Sampson, Arthur...Drummond, Ballykelly, Derry, Ireland
Sampson, John...Brympton, near Yeovil, Somerset
Samson, Thomas ..Kingston Russell, Dorchester
Sancton, Philip...the Ley, Leghane, St. Stephens, St. Albans, Herts
Sanday, Wm....Holme Pierrepont, Notts
†Sandbach, Hy. R....Hafodunos, Lanrwst, Denbighshire
†Sandbach, Saml., sen...Woodland, near Liverpool, Lancashire
†Sandbach, Saml., jun....Handley, near Chester
Sandby, Rev. George...Denton Lodge, Harlestone, Norfolk.
Sanders, E. A. ..Stoke House, near Exeter, Devon
Sanders, Henry...Harleston, near Northampton
Sanders, Joseph...Taplow House, Maidenhead
Sanders, Samuel...Fernhill, Newport, Isle of Wight
Sanderson, George...Mansfield, Nottinghamshire
Sandford, Mark...Martin, Dover
Sandford, T. H...Sandford Hall, Whitchurch, Salop
Sandham, Major...Rowdell, Steyning, Sussex
Sandle, Wm....Withersfield Place, Braintree, Essex
Sandwich, Earl of...Hinchingbroke House, Hunts.
Sankey, Richard...Nant, Holywell, Flintshire
Sargeaunt, Rev. John...Stanwick, Higham Ferrers, Northamptonshire
Sarney, Edw....Soundness, Nettlebed, Oxon.
†Satterfield, Joshua...Green Keys, Manchester
Saul, Wm....High Ferry, Sibsey, Boston, Lincolnsh.
Saunders, John E....Glanrhwdw, near Carmarthen
Saunders,RandleW...Nunwick Hall, Penrith, Cumberland
Saunders, Thos....Brightwell, Watlington, Oxon.
†Saunders, Thos. B....16, Brompton Square

Savile, Albany B....Arthur's Club
Savill, Robt. Maitland...Colchester, Essex
Savory, John...Rudham Grange, Rougham, Norf.
Savory, John...Burnham Overy, Lynn
Sawbridge, Hy. Barne...East Haddon, near Northampton
Sawers, John (Hon. E. I. C.)...Oriental Club, Hanover Square
Saxby, William...Rottingdean, Brighton
Saxon, John...Green's Combe, Bruton, Somerset.
Saxon, Samuel...Green's Combe, Bruton, Somerset.
Sayce, Morris...Kington, Herefordshire
Sayer, Daniel...27, Pottergate Street, Norwich
Sayer, Robert...Sibton Park, near Yoxford, Suffolk
Sayers, John ..Field-Dalling, near Holt, Norfolk
Scales, John...Agricultural College, Cirencester, Gloucestershire
Scarsdale, Lord...Kedleston Hall, near Derby
Scarth, Ed...Westside House, Darlington, Durham
Scarth, James...Newcastle-upon-Tyne
Scarth, Jonathan...Shrewsbury, Salop
Scarth, Thos. F....Keverstone, Darlington, Durham
Scarth, Wm. T....Keverstone, Darlington, Durham
Sclater, Wm. Lutley...Hoddington House, Odiham, Hampshire
Scobell, J. Usticke...Chewton House, Chewton Mendip, near Bath, Somersetshire
Scott Sir Edw. Bart...Great Barr Hall, Birmingham
Scott, G. D...Lovel Hill, Winkfield, Windsor, Berks.
Scott, Geo. G....Edenham, Bourn, Lincolnshire
Scott, J. B....Bungay, Sussex
Scott, Joseph...Colney Hall, Norwich, Norfolk
Scott, Robert...Stourbridge
Scott, Thomas...Beal, near Belford
Scott, Thos. Edw....Carbrook, Watton, Norfolk
Scott, Wm. Stephenson...Seal, nr. Farnham, Surrey
Scragg, Thomas...Calveley, Tarporley, Cheshire
†Scratton, D.R...Prittlewell Priory, Rochford, Essex
Scriven, George...Castle Ashby, Northampton
Scruby, Wm....Broxted, Dunmow, Essex
Scudamore, J....Abinghall, Mitcheldever, Gloucestershire
Scudamore, Lieut.-Colonel....Kentchurch Court, near Hereford
Scurr, Rev. Robt. William..Rector of Shenley, Stony Stratford, Bucks.
Seagrave, Rev. S.Y...Barton Rectory, Woodstock
Seaman, B. C. P.... Rotherby, Melton Mowbray, Leicestershire
Seaman, Robert...Norwich
Seamark, Richd...Mount St. Albans, near Caerleon, Monmouthshire
Searle, Wm....Sarsden, Chipping Norton, Oxon
Searson, Robt. ...Cramnon Lodge, Deeping St. James's, Market Deeping, Lincolnshire
Sedgwick, Professor...Trinity College, Cambridge
Seels, Henry John...Wainfleet, Lincolnshire
Selby, James...Otford Castle, Seven Oaks
Selby, Charles...Earle, Wooller
Selby, Leopold ..Pelton Colliery, Chester-le-Street
Selmes, Jas....Tufton Place, Northiam, Rye, Sussex
Selmes, James...Lea, Rye, Sussex
Senhouse, Captain Wm....Ashby St, Ledgers, Daventry, Northamptonshire
Seppings, Thos. Johnson...South Creake, Fakenham
Seppings, William...Lynn Regis
Severn, John Percy...Penybont Hall, Penybont, Radnorshire.
Severne, Thomas...Newent, Gloucestershire
Seward, Samuel...Weston, Petersfield, Hampshire
Sewell, Joseph...Cirencester, Gloucestershire
Sewell, Robt. B.... Newport, Isle of Wight
Sewell, Professor Wm....Royal Veterinary College, St. Pancras
Sewell, Russell...Little Oakley Hall, Harwich, Essex
Sewell, Rev. Thomas...Fingest House, Henley-on-Thames
†Seymer, K. H....Hanford, Blandford, Dorset
Seymour, Admiral Sir Geo. Francis, K.C.B....The Palace, Hampton Court
Seymour, Henry...Knoyle House, Hindon, Wilts.
Seymour, Henry, jun....Knoyle House, Hindon
Seys, William Æneas...Tutshill, near Chepstow, Monmouthshire
Shackel, Geo....Maple-Durham, Reading, Berks.
Shafto, Rev. A. Duncombe...Buckworth Rectory, Huntingdon
Shafto, Rev. J. Duncombe...Brancepeth Rectory, Durham
Shafto, R. Duncombe..Hampworth Lodge, Salisbury
Shafto, R. E. Duncombe...Whitworth Park, Rushyford, Durham
Shafto, T. Duncombe...Cheveney House, Hunton, Maidstone
Shand, Alexander...Rupert House, near Liverpool
Shanks, Wm....Bishop Auckland
Sharman, Alexander...Bedford
Sharman, John W....Wellingborough, Northampsh.
Sharman, Peter...Elsing, East Dereham, Norf.,
Sharman, Peter John..Scarning, East Dereham, Norf.
Sharp, Thomas...Northampton
Sharpe, James...Fawley-Court Farm, Henley-on-Thames
Sharpe, Joel...Pinchbeck, Spalding, Lincolnshire
Shaw, Thomas...Kilrie, Stonyford, Ireland
Shaw, William, jun....Far Coton, Northampton
†Shawe, R. F....Brantingham Hall, Hull, Yorkshire
Shawe, R. N....Kesgrave Hall, Woodbridge, Suffolk
Shawe, Samuel P....Hints Hall, Tamworth, Staffs.
Shearer, Bettesworth Pitt...Swanmore House, Bishop's Waltham, Hampshire
Shearm, Edward...Stratton, Cornwall
†Sheild, W. H... Landhawke, Langharne, S. W.
†Sheldon, Jonathan...Ensham, near Oxford
Sheldon, Wm....Stratford-upon-Avon, Warwicksh.
Sheffield, Earl of...Sheffield Park, Uckfield
Sheffield, Sir Robert, Bart...Normanby, Brigg, Linc.
Shelley, J. V....Maresfield Park, Uckfield, Sussex
Sheppard, John...High House, Campsey Ashe, Woodbridge, Suffolk
Sheppard, Sir Thomas Cotton, Bart....Crakemarsh Hall, Uttoxeter, Staffordshire
†Sherard, P. Castel...Glatton, Stilton, Hunts.
Sherborn, Francis...Bedfont, Middlesex
Sherborn, Mathew...Heston, Hounslow, Middlesex
Sherbroke, Henry Porter...Oxton, Southwell, Notts.
Sheridan, Richard Brinsley...Frampton House, Dorchester, Dorset

Sheriff, William...Treworgan, near Monmouth
Sheringham, Edward...Scrulthorpe, Fakenham
Sheringham, Edward, jun....Scrulthorpe, Fakenham
Sheringham, V. D....Thornage, Holt, Norfolk
Sherley, William...Catherine Wheel, Egham
Sherlock, Thomas...Kew, Surrey
Sherring, Ed....Milborne, Sherborne, Dorsetshire
Sherring, John...Milborne Wick, near Sherborne
Sherwin, J. S....Bramcote Hills, Nottingham
Sherwood, Richard...Chaddleworth, near Wantage, Berkshire
Shiffner, Sir Henry, Bart....Combe Place, Lewes
Shilcock, T. Beaumont...Hose Hall, near Melton Mowbray, Leicestershire
Shipman, William...Sedgebrooke, Grantham, Linc.
Shittler, John...Bradford Farm, Wimborne, Dorset
Short, Francis...Abbot's Leigh, Bristol
Short, Thos...Martin, near Bawtry, Nottinghamshire
†Shubrick, Major-Gen....The Grove, Leatherhead, Surrey
†Shuter, James...Chilton House, Kintbury, Berks.
Shuter, T. A....Hooley House, Coulsdon, Croydon, Surrey
Shuttleworth, John Spencer Ashton...Hathersage, near Bakewell, Derbyshire
Shuttleworth, Joseph...Pelham Street, Lincoln
Sibley, Robt...Kingsborne Green, Harpenden, Herts
Sidgreaves, James...Fishergate, Preston
Sikes, John...Sudbury, Suffolk
Sillar, Z....Rainford Hall, near Prescot, Lancashire
†Sillifant, John...Coombe, Crediton
Simcoe, Rev. H. A....Penheale, Launceston
†Simeon, Sir Rich., Bart....Swainston, Isle of Wight
Simmonds, Henry...Hadlow, Tonbridge, Kent
Simmons, James...Sutton Wick, Abingdon, Berks.
Simmons, John Messer...Killinganson, Truro
Simon, James...Greenfield, Holywell, Flintshire
Simonds, J. Charles...Fishtoft, near Boston, Linc.
Simonds, W. Barrow...St. Cross, near Winchester
Simpson, Henry B., jun....Eaton, Retford, Notts.
Simpson, John...Pyle Inn, Bridgend, Glamorgansh.
Simpson, John...Wyken Hall, Bardwell, Ixworth, Suffolk
†Simpson, Hon. John B....Babworth Hall, Retford
Simpson, Rich....The Cliffe, Douglas, Isle of Man
Simpson, William...29, Saville Row
Simpson, Rev. W. B....Babworth, Retford, Notts.
Sinclair, Archib....2, Chapel Street, Liverpool
Sisson, John...Plascock, St. Asaph, Flintshire
Sitwell, Chas. John...Stainesby House, near Derby
Sitwell, Edward Degge...Stainesby, Derby
Sitwell, Rev. H. W....Dunchurch, Warwickshire
Sitwell, Robert Sacheverell...Merley, near Derby
Skelton, Spencer..Sutton Bridge, Wisbeach, Cambs.
Skelton, Wm...Shrub House, Sutton Bridge, Wisbeach
Skingley, Henry....Wake's Hall, Wake's Colne, Colchester, Essex
Skipwith, Sir Gray, Bart...Newbold Hall, Brinklow, Rugby, Warwickshire
Skipwith, Henry Green...Rothwell House, Caistor
Skirving, William...15, Queen Square, Liverpool
Skynner, Rev. William...Rushden Vicarage, near Buntingford, Hertfordshire
Slack, Joseph A....32, Weymouth St., Portland Pl.
Slade, A. F....Kemnal House, Chiselhurst, Kent
Slade, Lieut. Edgar, R.N., ..Belmont, Chiselhurst
Slaney, W. Hen....Hatton Grange, Shiffnall, Salop.
Slater, Martin....Weston Colville, Newmarket, Cambridgeshire
Slatter, Wm....Stratton, near Cirencester
Sleight, Thomas...Rhyd, St. Asaphs, Flintshire
Small, Rev. Harry Alex. ...Rector of Haversham, near Stony Stratford, Bucks.
Smallpiece, Job...Compton, Guildford, Surrey
Smallpiece, John...Leith Hill Place, near Dorking, Surrey
Smallpiece, William Haydon...Guildford
Smallwood, E....York
Smart, Major George John...Tumby, near Boston
Smart, William...Rainham, Sittingbourne, Kent
Smart, William...2, Fig-tree Court, Temple
Smart, William Lynn...Linden, Woburn, Beds.
Smeddle, William...Ordnance Office, Tower
Smedley, Charles E. B....Swanton Morley, East Dereham, Norfolk
Smith, Augustus...Ashlyns Hall, Berkhampstead
Smith, Benjamin...Hastings, Sussex
Smith, Benjamin...Great Lodge, Tonbridge
Smith, Charles Brent...Whaddon, near Gloucester
Smith, Charles H....Gwconllwynwyth, near Swansea, S. W.
†Smith, Charles R....Southrop House, Fairford, Gloucestershire
Smith, Chas. Robert...Collingbourne Ducis, Marlborough, Wiltshire
Smith, Edward...Charlbury, Oxon
Smith, E. W....Routh, Beverley, Yorkshire
Smith, Francis...Salthill, near Chichester, Sussex
†Smith, George...The Luham, near Penrith, Cumberland
Smith, George...Potton, Biggleswade, Beds.
Smith, G. Robert...Selsdon Park, near Croydon Surrey
Smith, Sir Harry, Bart....The Cape of Good Hope
Smith, Henry ..Stamford, Lincolnshire
Smith, Henry...Maids Moreton Lodge, Buckingham
Smith, Henry...Drax Abbey, Selby, York
Smith, Hen...Heywood Farm, Waltham, Maidenhead
Smith, Henry...The Grove, Cropwell Butler, Bingham, Notts.
Smith, Henry Abel...Wilford, Nottingham
Smith, James...Stansted, near Chichester, Sussex
Smith, James ..Icklesham, Rye, Sussex
Smith, James...Wainfleet, Lincolnshire
Smith, James...Gwdwyr House, Whitehall
Smith, Jeremiah...Springfield, Rye, Sussex
†Smith, John...Welton Garth, Hull, Yorkshire
Smith, John...Spring Fields, Newcastle, Staffordsh.
Smith, John...Crownthorpe, Wymondham
Smith, John...Brancepeth, Durham
Smith, John...Lewes, Sussex
Smith, John...Weyhill, Andover, Hampshire
Smith, Col. John..Ellingham Hall, Bungay, Suffolk
Smith, John Geo....Manor House, Crediton, Devon
†Smith, John J....Down House, Blandford, Dorset
Smith, John K. ..Radbrook Villa, near Shrewsbury

Smith, Rev. John Tetley...Repton, near Derby
Smith, JohnThos...Thornby Grange, Northampton
Smith, John T....Goswick, near Berwick-on-Tweed
Smith, Sir John Wyldbore, Bart....Down House, Blandford, Dorsetshire
Smith, Rich....Marton Lodge, Bridlington, Yorksh.
Smith, Rich....Westacre, Droitwich, Worcestersh.
Smith, Richard...Kimberley, Norfolk
Smith, Richard B.....Huxley Farm, Edmonton, Middlesex
Smith, Robert...Heath Farm, St. Albans, Herts.
Smith, Robert...9, Stafford Street, Edinburgh
Smith, Robert...Emmett's Grange, South Molton, Devonshire
Smith, Right Hon. Rob. Vernon, M.P....Farming Woods, near Thrapstone, Northamptonshire
Smith, Rev. Sam. Colvy...Denver Rectory, Downham, Norfolk
Smith, Thos....Blore Hall, Ashbourne, Derbyshire
Smith, Thomas...Madeley, Shiffnall, Salop.
Smith, Thomas...Shareshill, Wolverhampton, Staffs.
Smith, Thomas...Reigate Lodge, Surrey
Smith, Thos. Deacon..Cashie Bridge, Watford, Herts.
Smith, Thos. G....Togston, Acklington, Northumb.
Smith, T. Hogan...Forberry Grove, near Newbury, Berkshire
Smith, Thomas, jun.... Chillingham Newtown Wooler, Northumberland
Smith, T. W....Greenfield Lodge, Oswestry
Smith, Timothy...Hoyland Hall, Barnsley
Smith, Sir William, Bart....Eardiston House, near Worcester
Smith, William...Easthope, Bottesford, near Nottingham
Smith, William...Hemel Hempstead, Herts.
Smith, William...West Rasen, Spital, Lincolnshire
Smith, Wm...Barton Mere, Bury St. Edmunds, Suffolk
Smith, William...Gaydon, Kineton, Warwickshire
Smith, William...Lilleshall, Shiffnal, Shropshire
Smith, William...Houghton Castle, Hexham
Smith, William...Sydenham
Smith, Wm. Burton...Belford, Northumberland
Smith, W. C....Shortgrove, near Saffron Walden, Essex
Smith, W. T....Brereton Lodge, Rugeley, Staffs.
Smithers, Sidney...Churchdale, Bakewell, Derbysh.
Smyth, Rev. Christopher...Little Houghton, near Northampton
Smyth, James...Peasenhall, Yoxford, Suffolk
†Smyth, John G...Heath Hall, Wakefield, Yorksh.
Smyth, Wm...Little Houghton, near Northampton
Smyth, Rev. Wm....South Elkinstone, Louth, Linc.
Smythe, J. W....Acton Burnell, Shrewsbury
Smythies, Carleton...Oak Lawn, Eye, Suffolk
†Smythies, Geo...Bickerstaffe Hall, Ormskirk, Lanc.
Smythies, Rev. J. R....East Hill, Colchester, Essex
†Snell, John F....Hundon, near Clare, Suffolk
Snibson, Richard...Bakewell, Derbyshire
†Snoulton, Osborne...
Snow, Johnson...Ewerby, near Sleaford, Lincolnsh.
Snowball, Joseph...Netherwitton, near Morpeth
Snuggs, Wm...Preston Condover, Alresford, Hants
Solly, S. R....Serge Hill, St. Albans, Hertfordshire
Somerset, John...East Wick, Pewsey, Wilts
†Somerville, J. C...Dinder House, Wells, Somerset
Somes, Samuel...Wollaston, near Wellingborough, Northamptonshire
Soulby, J. C....New Bolingbroke, Lincolnshire
Soulsby, C. P....Hulme Walfield, Congleton
Souter, Geo....Box Grove, near Chichester, Sussex
†Southampton, Lord...Whittlebury Lodge, Towcester, Northamptonshire
Southern, G. W....Kibblesworth, Gateshead
Sowerby, Francis...Aylesby, Great Grimsby
Sowerby, John...Shipcote House, Gateshead
Sowerby, Thomas.. Saltwell Vale, Gateshead
Spanton, Robert, jun....Little Thoms Farm, Swaffham, Norfolk
Sparham, James...Blakeney, Norfolk
Sparke, Alfred...Thorn Lane Foundry, Norwich
†Sparks, William...Crewkerne, Somersetshire
Spearing, Jno. B...Chilton, near Hungerford, Berks
Spearman, H. J., M.P. ...Newton Hall, Durham
Speke, William...Jordans, Ilminster, Somersetshire
Spelman, William...Norwich
Spencer, Francis...Claybrooke, Lutterworth, Leicestershire
†Spencer, Hon. F. G....9, King Street, St. James's
Spencer, John...Bishop's Lodge, Wrotham, Kent
Spencer, Jno...Odstone Hall, Measham, near Ashby-de-la-Zouch, Leicestershire
Spicer, John Wm....Esher Place, Esher, Surrey
Spilsbury, Samuel...Little Osbaston, Monmouth
Spinks, Abraham...West Bilney, Lynn
Spittal, Alexander...Douglas, Isle of Man
Spooner, Prof. Chas.. .Royal Veterinary College
Spooner, Lucius H....Beauly, N. B.
Spooner, Richard, M.P....Brickfields, Worcester
Spooner, William C....Southampton, Hants
Spoor, Richard...Whitburn, near Sunderland
Spraggon, Mark...Nafferton, Newcastle-on-Tyne, Northumberland
Springett, Robt....Twysden, Goudhurst, Cranbrook, Kent
Spurgin, Dr....Orplands, Bradwell, Essex
Spurling, John...Shotley, Ipswich, Suffolk
Spurling, Wm....Grange Farm, Worlingworth, Suff.
Spurr, Jeremiah...Wigthorpe, near Worksop, Notts
Squire, William...Yarmouth, Isle of Wight
Stable, R. S....Willesley, Cranbrook, Kent
Stables, Walter...Crossland Hall, Huddersfield
†Stables, W. A. . .Cawdor Castle, Nairnshire, N. B.
Stace, William...Berwick, Lewes, Sussex
Stacy, Wm...Barton Farm, Abingdon, Berkshire
Staffurth, Samuel...Ramsey, Huntingdonshire
Staffurth, William...Ramsey, Huntingdonshire
Stainsby, Mark, jun....30, Lady Pitt Lane, Leeds
Stainton, John...Dalby, Spilsby, Lincolnshire
Stallard, Joseph...Redmarley, near Gloucester
Stallard, William...Blankets, near Worcester
Stamford and Warrington, Earl of...Enville House, Stourbridge
Stammers, J. B....Holywell Cottage, St. Albans
Stanbrough, Chas. H....Isleworth, Middlesex
Stanbrough, James...Isleworth, Middlesex

†Standish, W. S....Duxbury Park, Chorley, Lanc.
Stane, J. B....Forest Hall, Ongar, Essex
†Stanhope, J. B....Reresby Abbey, Horncastle, Lincolnshire
Stanier, Chas....Uppington, Wellington, Shropshire
Stanier, Edw....Wroxeter, Shrewsbury, Shropshire
Stanier, Jno....Leaton, near Wellington, Shropshire
Staniforth, Rev. Thos....Bolton Rectory, Clitheroe
Stanley, Charles...Denhall, Neston, Cheshire
Stanley, Edward...14, Grosvenor Square
†Stanley, Hon. E. H....Knowsley, Prescot
Stanley, Wm. Hans Sloane, jun...21, Curzon Street, May Fair
Stanley, Wm. Proctor...Peterborough
Stanton, W. H....Stroud, Gloucestershire
Staples Browne, R. T...Launton, Bicester, Oxon
Stapleton, Valentine...Stow Gate, Market Deeping, Lincolnshire
Stark, William...Norwich
Statham, Rev. R. J....Rector of Tarporley, Cheshire
Statter, Thomas...Knowsley Hall, Bury, Lancashire
Staunton, Rev. Dr. ... Staunton Hall, Grantham, Lincolnshire
Stedman, Dudney...Horsham, Sussex
Stedman, Robt....Pakenham, Ixworth, Suffolk
Stedman, Robt....Great Bookham, near Leatherhead, Surrey
Steedman, E. H....High Ercal, Wellington, Salop
Steel, Geo., jun...Depden Elms, Bury St. Edmunds
Steel, William...Abergavenny, Monmouthshire
Steele, John...Epsom, Surrey
Stenning, Edward...Godstone, Surrey
Stenning, William...Godstone, Surrey
Stenning, Wm....Halsford, East Grinstead, Sussex
Stent, Bridger...Frittleworth, Petworth
Stephens, Charles...Reading
Stephens, Evan...Berton, St. Ishmaels, near Carmarthen
Stephens, Rev. F. T....St. Mawgan, Cornwall
Stephens, Henry Lewis...Tregenna Castle, Hayne, St. Ives, Cornwall
Stephens, John...The Abbynes, near Bridgnorth, Salop
Stephens, John...23, Eastbourne Terrace, Hyde Park
Stephens, S. J....5, Charlotte Street, Portland Place
Stephens, Wm....Prospect Hill, Reading, Berks
Stephens, Wm. Vernon...186, Fleet Street
Stephenson, Marshall...Fourstones, Hexham, Northumberland
Stephenson, Wm....Throckley, Newcastle-on-Tyne
Stevens, Alfred...Tongham Manor, Farnham
†Stevens, John...Holywell Street, Oxford
Stevens, J. C. M...Winscott, near Torrington, Devon
Stevens, J. T....Seaborough, Crewkerne, Somerset.
Stevens, Robert...Watton, Norfolk
†Stevens, Rev. Thos....Bradfield Rectory, Reading, Berks
Stevenson, J. A....Madeley Park Farm, Newcastle, Staffordshire
Stevenson, S. W....Surrey Street, Norwich
Steward, A. B....Chapel House, near Whitehaven
†Steward, Charles...Blundeston, Lowestoft, Suffolk
Steward, R....The Armoury, Great Yarmouth
Stewart, Sir W. D....Murthly, Perth, N. B.
Stickney, William...Ridgmont, Hull, Yorkshire
Stiles, Thomas...Pinchbeck, Spalding, Lincolnsh.
Stilwell, James...Killinghurst, Haslemere, Surrey
Stirling, W. M....Abercairny, Perth
Stock, Sam....Blackley Hurst, St. Helens, Lanc.
Stockley, Joshua...Ivetsey Farm, Weston, Shifnal, Salop
Stokes, Charles...Kingston, Kegworth, near Derby
Stokes, Jonathan...Stamford Rivers, Romford, Essex
Stokes, Thomas...New Park, Leicester
Stone, Joseph...Dorchester, Dorsetshire
Stone, N. C....Rowley Fields, Leicester
Stone, T. P....Barrow, Loughborough, Leicestersh.
Stone, W. F. Lowdues..Brightwell, near Tetsworth, Oxon
Stopford, W. Bruce...Drayton House, near Thrapstone
Storer, Charles...Lowdham Grange, Nottingham
Storer, Rev. John...Hawksworth, near Newark, Notts
Storey, Ralph..Beamly, near Alnwick, Northumb.
Stott, Robert...Tanfield, Chester-le-Street, Durham
Stow, William...Farnborough Hall, Kent
Stowell, W. S....Faverdale House, Darlington
Stracey, Sir E....Rackheath Hall, Norwich
†Stracey, H. J....The Grange, Sprowston, near Norwich
Stracey, John...Sprowston Lodge, Norwich
Strachan, J. M....Teddington Grove, Middlesex
†Strahan, William...Ashurst, Dorking
Strafford, Henry...3, Camden Villas, Camden Town
Straker, John...Jarrow Lodge, Durham
Strangways, H. B....Shapwick, Glastonbury, Somerset
Strathallan, Viscount of.. Castle Strathallan, Auchterarder, N. B.
Stratton, Alfred...Rushall, Pewsey, Wiltshire
Stratton, B. T....Bristol
†Stratton, J. L...Turveston House, Brackley, Northamptonshire
Stratton, James...93, Castle Street, Reading
Stratton, William.. Upavon, Pewsey, Wiltshire
Streatfield, R. S....Rocks, Uckfield
Streeter, William...Sanderstead, Croydon, Surrey
Stretton, Alexander...Bunny, near Nottingham
†Strickland, C. W...Boynton, Bridlington, Yorksh.
Strickland, H. E....Tewkesbury Lodge, Tewkesbury, Gloucestershire
Strickland, Walter...Cokethorpe Park, Witney, Oxon
Strode, George...Newnham Park, Plympton St. Mary, Devon
Stronge, Thomas...Cirencester, Gloucestershire
Stroud, William...Swansea
Strouts, Edward...St. Dunstan's Place, Canterbury
Strutt, John...Bridge Hill, Belper, Derbyshire
Stuart, Henry, M.P...Kempston, near Bedford
Stubbs, Charles...Preston Hill, near Penkridge, Staffordshire
Stubbs, Frederick...Wetmoor, near Ludlow
Stubbs, Walter...Beckbury, Shifnal, Salop
Stunt, Frederick...Higham, near Rochester

Stunt, John...Gillingham, near Chatham, Kent
Sturgeon, T. B....South Ockenden Hall, Romford, Essex
†Sturt, H. C., M.P....16, Portman Square
Stutfield, William...Hildersham, Cambridge
Suggers, George...Hurstperpoint, Sussex
Sumner, Rev. C. V. H....Hatchlands, Guildford, Surrey
Sumner, Col. Holme...Hatchlands Park, Guildford, Surrey
Surtees, Robt. L....Redworth House, Darlington
Swaffield, Benjamin...Chatsworth, near Chesterfield, Derbyshire
Swaffield, Samuel...Ampthill Park, Bedfordshire
Swaine, Charles...Wrangle, Boston, Lincolnshire
Swaine, Thomas...Buckingham
Swan, J. W....Hockham, near Larlingford, Norfolk
Swan, W. R....Walls' End, Newcastle-upon-Tyne, Northumberland
Swann, George...York
Swann, James... High Onn, Stafford
†Swete, J. Beaumont...Oxton House, Exeter
Swinborne, Robert...Great Oakley, near Colchester, Essex
Swinburne, Joseph...Knutsford, Cheshire
Swinburne, R. W....Cleadon Cottage, near South Shields
Sydney, Viscount...3, Cleveland Square
Syer, Rev. Thomas...Little Wratting, Clare, Suffolk
Sykes, Edmund....Mansfield Woodhouse, Notts
†Sykes, Sir Tatton...Sledmere, Malton
Symonds, John...Symondsbeg, Bridport, Dorsetshire
Symonds, T. P....Pengethy, near Ross, Herefordsh.
Symonds, William...Milborne St. Andrew, near Blandford, Dorset
Symons, Thomas...Coryton, Launceston, Cornwall
Symons, Thomas George...Mynde Park, Hereford
†Synge, F. H....Weston-super-Mare, Somersetshire

Taber, James...Lawford, Colchester, Essex
Tabley, Lord de...Tabley House, Northwich, Cheshire
Tabrum, Litchfield...Boishall, near Ongar, Essex
Talbot, Earl...Ingestre, near Stafford
Talbot, C. R. M., M.P....Margam, Glamorganshire
Talbot, Sir George, Bart....21, Grosvenor Square
Talbot, Miss...Temple Guiting, Cheltenham, Gloucestershire
Talbot, R. R....Wickford, near Rochford, Essex
Talbot, Hon. and Rev. W. C....Ombersley, Stourport, Worcestershire
Talbot, W. Hawkshead....Scarisbrooke Hall, Ormskirk, Lanc.
Talbot, Wm. Hollings...Preston Patrick, Burton, Westmoreland
Tallant, John.. Little Houghton Lodge, Northamp.
Tancred, Sir Thomas, Bart...Stratton House, Cirencester
Tanner, A. O....Brook House, Edmonton
Tanner, James... Kingsnympton, Chumleigh, Devon
†Tanner, William...Patcham, near Brighton
Tanner, William...Nethercott Farm, Rose Ash, South Molton, Devon
Tarleton, Rev. J. E....Chelsfield St. Mary, Foot's Cray, Kent
Tasker, William....Waterloo Iron Works, Andover, Hants
Tatham, T. J....27, Bedford Place, Russell Square
Tattersall, Edmund...Grosvenor Place
Tattersall, Edward....Newmarket
Tattersall, John...58, Ebury Street, Pimlico
Taunton, W. E....Freeland Lodge, Ensham, Oxon
Taunton, W. P....Ashley, near Stockbridge, Hants
Tawke, Arthur...Norwich
Tawney, A. R....Banbury
†Tawney, Charles...Oxford
Taylor, Sir Charles, Bart....Holly Combe Lodge, Liphook, Hants
†Taylor, C. H....Bamburgh Friars, Belford, Northumberland
Taylor, Frederick...Worcester Park, Ewell, Surrey
Taylor, F. Manley Shawe...Castle Taylor, Ardrahan, Galway, Ireland
Taylor, George...Wolverhampton, Staffordshire
Taylor, George...Brecon
Taylor, Henry...Dilham Hall, Norwich
Taylor, Henry...Bampton, Oxon
Taylor, Henry John...Hay Gate, Wellington, Salop
Taylor, Hugh...Cramlington, Newcastle-upon-Tyne
Taylor, Isaac...Shrewsbury, Salop
Taylor, John...Brewers Hall, Mereworth, Kent
Taylor, John...Morton Hall, Whalley, Lanc.
Taylor, John, jun....Essex Standard Office, Colchester
Taylor, J. O....Hardingham, Norwich
Taylor, J. P....Treeton, Rotherham
†Taylor, Joseph...Bishops Stortford, Herts
†Taylor, Richard...Penmear, near Falmouth
Taylor, Robert...Treeton Mills, Rotherham
†Taylor, Sam....Eccleston Hall, Prescot, Lancashire
Taylor, Silas B....Foxhall, Upminster, Essex
Taylor, Thos....Burleigh Villa, Wellington, Salop
Taylor, T. L....Starston, Harleston, Norfolk
Taylor, Wm....Showle Court, Stoke Edith, Hereford
Tayton, William...Syderstone, Fakenham
Tebbitt, Walter...Cottage House, Clapham Common
Tekell, John...Frimley Park, near Bagshot, Surrey
Tempest, Sir Charles...Broughton Hall, Skipton, Yorkshire
Tempest, Henry...Newland Park, Wakefield
Templeman, John...Merriott, Crewkerne, Somersetshire
†Templemore, Lord...Dunnoby Park, Wexford, Ireland
Tench, John... Ludlow, Salop
Tench, Richard...Ludlow, Salop
Tennant, J.R....Kildwick Hall, Skipton, Yorkshire
Thackwell, J. C...Wilton Place, near Ledbury, Herefordshire
†Thew, Edward ..Lesbury House, Alnwick, Northumberland
Thexton, John Yeates...Ashton House, Milnthorpe, Westmoreland
Thomas, David...Brecon
Thomas, E. D...Welfield House, Builth, near Brecon
Thomas, F. H....Hereford

Thomas, George...18, Redcliff Street, Bristol
Thomas, Rev. George...Llandaff Court, near Cardiff, Glamorganshire
Thomas, Ilted...Hill House, Swansea, Glamorgansh.
Thomas, J. Ayre...Ditchet, Rose Ash, Witheridge, Devon
Thomas, John, jun....Ynissiwnd, near Neath, N.W.
Thomas, Le Marchant...Billingbear Park, Wokingham, Berks
Thomas, R. G....Llysnewydd, near Carmarthen
Thomas, T. E....Glanmor, Swansea, S. W.
Thomas, William...Dadnor, near Ross, Herefordsh.
Thompson, Andrew...Keele, Newcastle-under-Lyme
Thompson, Rev. Cornelius...Kirton Rectory, Ollerton, Notts
Thompson, Henry A....Lewes
†Thompson, H. S....Moat Hall, near Boroughbridge
Thompson, James...Kirkhouse, Brampton, Cumberland
Thompson, John...Paston, near Wooler, Northumberland
Thompson, John...Woolvers Farm, Reigate, Surrey
Thompson, Leonard...Sherriff Hutton Park, York
Thompson, Robert...Norwich
Thompson, R. J...Kirby Hall, near York
Thompson, John S...Clements, Ilford, Essex
Thompson, Wm...12, Dunsford Place, Bathwick, Bath
†Thompson, Wm., M.P....Underby Hall, Kirby Lonsdale
Thompson, William...Bishop Auckland, Durham
Thompson, W. C. F...Solway House, Carlisle, Cumberland
Thomson, Guy...Old Bank, Oxford
Thomson, Henry...Primrose, Clitheroe, Lancashire
Thornewill, Edward...Dove Cliffe, Burton-on-Trent
Thornhill, George, M.P....Diddington, Buckden, Hunts
Thornhill, George, jun...Harefield, Cheam, Surrey
†Thornhill, Thomas...Riddlesworth Hall, Thetford, Norfolk
†Thornhill, W. Pole...Stanton, Bakewell, Derbys.
Thornthwaite, Joseph...Arkleby House, Cockermouth, Cumberland
Thornton, Claude G...Marden Hill, near Hertford
Thornton, Harry...Turvey, Newport Pagnell, Bucks
Thornton, Rev. John...Kimbolton
Thornton, Stephen...Moggerhanger House, Biggleswade, Beds
†Thorold, Richard...Weelsby Hall, near Grimsby
Thorold, William...Norwich
Thorp, Archdeacon Charles...Ryton Rectory, Newcastle-on-Tyne
†Thorp, Archdeacon Thomas...Kemerton Rectory, Tewkesbury
†Thorp, Thomas...Alnwick, Northumberland
Thorpe, James Cole...Otley, Walesby, Market Rasen, Lincolnshire
Thorpe, John...Pitt, near Hastings
†Thorpe, John...Shenton, Hinckley
Thoume, James...Guernsey
Thoyts, Mortimer Geo...Sulhamstead House, near Reading, Berkshire
Threlfall, Lazarus...Lancaster
Thresher, Frederick...Bentley, Farnham, Surrey
Thring, Rev. J. G...Alford House, Castle Carey, Somersetshire
†Throckmorton, Sir R. G....Buckland, near Faringdon, Berkshire
Thruston, Capt. C. T., R.N...Talgarth, Machynlleth, Montgomeryshire
Thurlow, Rev. Thos....Baynards Park, Guildford
Thurnhall, Henry...Royston, Herts
Thursby, Rev.—...Abingdon Rectory, Northampton
Thursfield, Wm....Barrow, near Broseley, Salop
Tigar, Pennock...Grove House, Beverley
†Tighe, Rt. Hon. W. F....Woodstock Park, Inistroge, Ireland
Tilden, John...Ifield Court, Gravesend, Kent
Tillett, Samuel...Hill House, Lexden, Colchester
Tilley, Joshua...Gurston, Redstone Hill, Reigate
Tilly, Tobias H....Tremough, Falmouth, Cornwall
†Tillyard, Philip...Godmanchester, near Huntingdon
Tillyer, George...Feltham, Middlesex
Tillyer, James, jun....Yeavenly Farm, Staines, Middlesex
Timings, Richard...Wacton Court, near Bromyard
Timm, Dr. C...Scrooby House, Bawtry, Notts.
Timm, Joseph...Champion Hill, Camberwell
Timm, William...Ratcliff Grange, Worksop, Notts
Timms, William...Cadley Hill, Burton-on-Trent
Timson, Rev. Edward...Woodlands House, near Southampton
Tindal, Thomas...Aylesbury, Bucks
Tindale, Benj...Mount Pleasant, Dawlish, Devon
Tindale, Wm....Wheatley, Doncaster
Tingey, John...Scoulton, Hingham, Norfolk
Tinker, William...Conock House, Devizes
Tinkler, Richd....Bolton, Westmoreland
Tinling, Capt. Charles.. 4, York Place, Worthing
Tinne, John A...Briarley, near Aigburth, Liverpool
Tisdale, Thomas...Quarry Terrace, Shrewsbury
Todd, F. S...Picton House, Newcastle-upon-Tyne
Todd, Joseph...New Shipton, Sutton Coldfield, Warwickshire
Todd, W. R...Picton House, Newcastle-upon-Tyne
†Tollemache, H. B....Junior United Service Club
†Tollemache, John...Tilston Lodge, Tarporley, Cheshire
Toller, Samuel...Gedgrave, Orford, Suffolk
Tollet, Geo....Betley Hall, near Newcastle, Staffs.
Tombs, Edw....Maizey Hampton, Fairford, Glouc.
Tombs, John...Hanghill, near Cirencester, Glouc.
Tombs, Joseph...Haverfordwest, Pembrokeshire
Tomkins, W. S....Broughton, near Stockbridge Hants
Tomkinson, Wm....Newcastle, Staffs.
Tomline, Col. Geo., M.P...1, Carlton House Terrace
Tomlinson, Capt. Frederick...Cliffe Ville, Newcastle-under-Lyme, Staffordshire
Tomlinson, Sam....Sutton Place, St. Helens, Lanc.
Tomlinson, William...Biggins House, Kirkby Lonsdale, Westmoreland
Tompsett, James...Hextall Court, East Peckham, Kent

Tompson, C. Kett...Witchingham Hall, Norwich
Tompson, H. Kett...Burgh Apton Cottage, Norwich
Tompson, Rob. Jas...Round Coppice, Iver, Bucks
Tomson, James...Barnt Green, Bromsgrove
Tonge, John, jun....Edenbridge, Kent
Tonge, Wm., sen....Morante Court Farm, Chevening, Sevenoaks, Kent
Tonge, Charles...Branston, near Lincoln
Tongue, Edward...Aldridge, Walsall, Staffordshire
Tongue, Wm...Comberford, near Tamworth, Staffs.
Tooke, William..12, Russell Square
Topham, James...West Keal, Spilsby, Lincolnshire
Topham, Robert...Mowthorpe, Malton, Yorkshire
†Torkington, James...Stukeley, Huntingdon
†Torr, Wm...Aylesby, Great Grimsby, Lincolnshire
Toulson, John P....Skipwith Hall, Selby, Yorks.
Tower, Christ. T...Weald Hall, Brentwood, Essex
Towers, John...Park Place, Fairfield, Croydon
Towneley, Chas...Towneley, Burnley, Blackburn, Lancashire
Townley, Rev. Gale...Beaupré Hall, Wisbeach, Cambridgeshire
Townsend, Rich. Edw....Springfield, Norwood
†Townsend, Thos...Hillmorton, Rugby, Warwicks.
Townsend, Wm. Hicks...3, Montague Parade, Bristol
Townshead, Geo....Sapcote, Hinckley, Leicesters.
Trafford, Sir Thos. De, Bart....Trafford Park, Manchester, Lancashire
Traherne, Rev. John M....Coedrigtan, near Cardiff, Glamorganshire
Trebeck, Thomas...Southwell, Notts
Treby, H. H...Goodamoor, near Plympton, Devon
Tredwell, J. C...Oddington Grange, Bicester, Oxon
Tremenheere, Seymour...105, Pall Mall
Trenchard, Rev. John A...Stanton House, Swindon, Wiltshire
Trench, Richard...Freehill, Southampton, Hants
Trench, William...Cangort Park, Roscrea, King's County, Ireland
Tresawna, Sampson...Probus, near Truro, Cornwall
Tress, Wm...1, Princes Street, Wilson St., Finsbury
Trethewy, Henry...Grampound, Cornwall
Trethewy, Henry, jun....Silsoe, Beds
Trevor, Hon. Gen....Glynde, near Lewes, Sussex
Trollope, Sir John, Bart., M.P....Casewick, Stamford, Lincolnshire
Trollope, Capt. W. H...Landford House, Salisbury
Trood, Edward...Matford House, Exminster, Devon
Trotter, Geo. Dale...Bishop Middleham, Darlington
Trotter, John...Staindrop, near Darlington, Durham
Trotter, Robert...Twyford, East Grinstead, Sussex
Trotter, Thomas...Bywell, Newcastle-on-Tyne
Trower, Capt. E. S...Watton House, Ware, Herts
Trower, Henry S...Castle Thorpe, near Stony Stratford, Bucks
Trudgen, H. H...Trevelley, Penzance, Cornwall
Trumper, Edward...Nuneham Park, near Oxford
Trumper, Robert, Wyke Farm, Isleworth, Middx.
Trumper, William...Iver, Colnbrook, Bucks
Trustram, John...Higham Gobion, Ampthill, Beds
†Tryon, Thos...Bulwick, Wansford, Northamptonsh.
Tuck, Rev. G. R...Rectory, Wallington, near Baldock, Herts
Tuck, Henry...Avon, Ringwood, Hampshire
Tuck, John Henry...Blofield, near Norwich
Tuck, John J....Wortham, Eye, Suffolk
Tuck, T. G....Strumpshaw, Norwich
†Tucker, Henry...Coleraine House, Stamford Hill, Middlesex
Tuckett, Alfred...Moorend, Mangotsfield, near Bristol
Tuckey, Thomas...Compton-Beauchamp, Faringdon, Berkshire
Tuckwell, Humphrey...Signet, near Burford, Oxon
†Tudway, R. C....Wells, Somerset
†Tull, Edward..Peasemore, Newbury, Berks
†Tull, Henry...Crookham, Newbury, Berks
†Tull, Richard...Crookham, Newbury, Berks
Tullidge, William...Houghton Farm, Blandford
Tunnicliffe, Fred. W...Biana, Eccleshall, Staffs.
Tupholme, Thomas...Horncastle
†Turnbull, John Geo...2, Sussex Square, Bayswater
†Turnbull, Rev. T. S....Blofield, Norfolk
Turner, Ellis...Caston Hall, Watton, Norfolk
Turner, George...Flitching, Uckfield, Sussex
Turner, George...Barton, near Exeter, Devon
Turner, Lieut.-Col. Henry...32, Argyll Street
Turner, Henry John...Richmond, Yorkshire
Turner, James S....Clinton Farm, Seaford, near Lewes, Sussex
Turner, John...Trowse, Norwich
Turner, John...Gravetye Manor, West Hoathly, near East Grinstead, Sussex
Turner, John Beresford...Worcester
Turner, John Henry...Little Horringer Hall, Bury St. Edmunds
Turner, Sam...Branch Bank of England, Liverpool
Turner, Thos...Castwood Farm, Rotherham, Yorks.
Turner, Wm. B....Feltham Hill, Hounslow, Mid.
Turner, W. H...8, Mount Place, Whitechapel Road
†Turnor, Christopher...Stoke, Grantham, Lincolns.
Turnor, Michael...Brereton, Rugeley, Staffs.
Turnor, Thos....Abbotts Bromley, Rugeley, Staffs.
Twemlow, Thomas...Peatswood, Drayton, Salop
Twining, F...Parbold Hall, Standish, Wigan, Lanc.
Twitchell, Thomas...Willington, near Bedford
Twort, Tyler...Horsmonden, Kent
Tylden, Lieut.-Col. Sir J....Milsted, Sittingbourne, Kent
Tyler, John...Layton, Essex
Tyler, Rev. R. T....Llantrithyd, near Cardiff, Glamorganshire
Tynte, Lieut.-Col. C. J. K...Cefn Mably, Newport, Monmouthshire
Tyrconnel, Earl of...Kiplin, Catterick, Yorkshire
Tyrell, Sir John, Bart...Boreham House, Chelmsford
Tyssen, W. G. D...Foulden Hall, Brandon, Norfolk

Ullock, Thomas...Quarry How, Bowness, near Kendal, Westmoreland
Umbers, Abraham...Weston Hall, Leamington
†Umbers, Edward...Weston Hall, near Warwick
Umbers, Samuel...Cubbington Heath, near Leamington
†Underwood, Joseph...Blackheath Park, Kent
Underwood, Capt. W....Castle Hill, Bakewell Derbyshire

Unett, J. W....Smethwick, Birmingham
†Upperton, Robert...35, Steyne, Brighton, Sussex
Uppleby, Leadbitter...Wootton House, Barton-on-Humber, Lincolnshire
†Upton, Hon. Gen. G. F....G2, Albany
Upton, H. J....Aldwick, Bognor, Sussex
Urry, Barnabus...Newport, Isle of Wight
Urwick, Edward...Felton, Ludlow, Salop
Utting, John...Stunning Hall, Norfolk

Vaisey, Thomas...Stratton, near Cirencester, Glouc.
Vaizey, Geo. De Horne...Halstead, Essex
Vallance, James...Hurstperpoint, Sussex
Vanderstegen, W. H....Cane End House, near Henley, Oxon
Vandeleur, George...King's Newton Hall, Derby
†Vane, Rev. John...Dulwich, Surrey
Vansittart, Geo. H....Besham Abbey, Great Marlow
Vardon, Thos. (Librarian of the House of Commons)
Vaughan, Hugh...Redland House, near Bristol
Vaughan, John...Velin Newidd House, near Brecon
†Vaughan, Nash V. E....Rhesla, near Neath, Glamorganshire
Vaughan, Sir R. W....Hengurt, Dolgelle, Merionethshire
Vaughan, Rev. Thomas...Llandwailog, Brecon
Vaughan, Col. Wright...Woodstone, Peterborough
Veal, John B...Ringmer, near Lewes, Sussex
Veale, J. H...Passaford, Hatherleigh, Devon
†Vere, John...Carlton-upon-Trent, Newark, Notts
Verelst, Rev. Wm....Grayingham, Kirton-in-Lindsey, Lincolnshire
Verity, Richard...Dean, Kimbolton, Hunts
†Verney, Sir Harry, Bart., M.P.....Claydon House, Winslow, Bucks
Vernon, Geo. Croft...Mount Flanbury, Bromsgrove, Worcestershire
Vernon, G. H., M.P....Grove Hall, East Retford, Notts.
Vernon, Hon. and Rev. J. V...Nuttall Rectory, near Nottingham
Viall, King...Stoke, Clare, Suffolk
Vibant, James...Chilliswood House, Taunton
Vickers, Samuel...Sprotborough, Doncaster
†Vickers, Valentine...Ellerton Grange, Newport, Salop
Villiers, Viscount...Upton Park, Banbury
Vincent, Henry Wm....Queen's Remembrancer's Office, Duke Street, Westminster
Vincent, James...Clifton Maubank, Sherborne
Vincent, John Fras...Frostenden, Wangford, Suff.
Vines, Richard...13, Great College Street, Camden Town
Vivian, George...Claverton Manor, Bath, Somerset
Vivian, John Henry...Singleton, Swansea
Vivian, Lord...Plas Gwyn, Beaumaris, Anglesea
Vizard, Wm...16, New Street, Spring Gardens
Vogan, Rev. Thomas S. L....Vicar of Walberton, Arundel
Voss, Wm...West Bucknowle, Corfe Castle, Dorset
†Vyner, Henry...Newby Hall, Ripon

Waddington, H. S...Cavenham, Mildenhall, Suff.
Waddington, J. H...Langrish, Petersfield, Hants
Waddington, John T....Twyford Lodge, near Winchester, Hants
Wade, Rev. Albany...Elton Rectory, Stockton-on-Tees, Durham
Wade, Major H. C...Hanxwell Hall, Bedale
Wadham, Thomas...Frenchay, near Bristol
Wagner, G. H. M...Hurstmonceaux, Battle, Sussex
Wagstaff, Edward...Gordon Castle, Fochabers, N. B.
Waite, W. S...Woodborough, Bath, Somersetshire
Wake, Bartholomew...North Barrow, Castle Carey, Somersetshire
Wakefield, George ... Minworth, Birmingham, Warwickshire
Wakefield, John ... Sedgwick House, Kendal, Westmoreland
Wakeman, Thomas...Chalfont St. Giles, Gerard's Cross, Bucks
Wakley, James...111, Pilgrim Street, Newcastle-upon-Tyne
Walbey, Henry...Wyddial, near Buntingford, Herts
Walbey, Thos. C...Barley, near Royston, Herts
Walkden, Thos...Rushall Down, near Pewsey, Wilts
Walker, David...Maidstone
Walker, Delabere...Netherwood, Tenbury, Worcestershire
†Walker, George...Eastwood, near Nottingham
Walker, Geo. J. Alexander...Norton, near Worcester
Walker, Geo. R...Heathfield House, near Oxford
Walker, Gibbon N....Market Cell, Market Street, Herts
Walker, James...Suttie, near Kintore, N. B.
Walker, James...Northleach, Gloucestershire
Walker, Capt. J. R....Gilgarran, Whitehaven
Walker, John...York
Walker, John ... Westfield House, Holmer, near Hereford
†Walker, Ormerod Oliver...Bury, Lancashire
Walker, Dr. Thomas...10, Lower Seymour Street, Portman Square
Walker, Thomas...Kendal, Westmoreland
Walker, Thomas...Cockermouth
Walker, Thomas...The Bank, Doncaster, Yorkshire
Walker, William...Wilsie, near Doncaster
Waller, H.S...Farmington, Northleach, Gloucestersh.
Waller, James...Digswell Hill, Welwyn, Herts
Wallington, James...Charlecote, Stratford-on-Avon
Wallis, Owen..Overstone Grange, near Northampton
Wallis, Robert...South Shields
Wallis, Samuel...Barton Seagrave, Kettering
Wallis, W. F....New Shifford Farm, near Witney, Oxon
Walmsley, John...Creamore, Wem, Salop
Walmsley, Thomas...Ribblesdale Place, Preston, Lancashire
Walrond, Lloyd B...Flanley, Westbury-on-Severn, Gloucestershire
Walsh, John...Oxford
Walter, John....Gore House, Upchurch, Sittingbourne, Kent
Walter, Stephen...West Farleigh, Maidstone
Walter, Wm...Rainham, Upchurch, Sittingbourne, Kent
†Walters, James W...Barnwood, near Gloucester
Walters, John...Derby

Walters, Robert ... Charlotte Square, Newcastle-upon-Tyne
†Walton, Thomas...Albany House, Old Kent Road
Walton, Wm...Merdon Farm, Hursley, Winchester
Warburton, R. E. E...Harley Hall, near Northwich, Cheshire
Ward, David...Iron Works, Melford, near Sudbury, Suffolk
Ward, G. A....Downham Bridge, Norfolk
Ward, H. W....Lindurn Road, Lincoln
Ward, John...79, Bishopsgate Street Within
Ward, R. M....Watton, Norfolk
Ward, T. E....The Lodge, Chirk, Denbighshire
Ward, T. R....Upton, Slough, Bucks
Ward, W. S....Wellow Hall, Ollerton, Notts
Ward, W. T....26, Old Elvet, Durham
Warde, Charles...Squerries, Westerham, Kent
†Ware, Samuel...34, Portland Place
Waring, William...Chelsfield, Kent
Warman, Robert...Idstone, near Faringdon, Berks
Warner, Frederick...28, Cornhill, London
†Warner, George...Priory, Hornsey, Middlesex
Warner, Henry...The Elms, Loughborough
Warner, H. J. L., jun....Tibberton Court, near Hereford
Warner, James...Tixall Hall Farm, Great Haywood, near Stafford
Warner, William...Botley, Southampton, Hants
Warre, Henry...15, Upper Wimpole Street
Warre, J. A....West Cliff, Ramsgate, Kent
†Warren, Rev. J. C. B...Horkesley Hall, Colchester, Essex
Warren, Richard...Shillington, Blandford, Dorset
Warry, Elias T....Wimborne, Dorset
Warry, George...Shapwick, Glastonbury, Somerset
Warsop, John...Alconbury Hill, near Huntingdon
Warter, Henry de Grey...Meole, Shrewsbury
Wartnaby, John...Clipston, Northamptonshire
†Wasey, J. T. .. Prior's Court, near Newbury, Berks
Washbourne, T. E...Donnington, Newbury, Berks
Washbourne, W. E., jun....Tillingdown, Tandridge, Surrey
Wason, Rigby...Kildonan, Newton-Stewart, N. B.
Wass, Joseph...Lea, near Matlock, Derbyshire
Waterhouse, Daniel...Aigburth, near Liverpool
Waterhouse, Edward...Liverpool
Waterpark, Lord...Doveridge Hall,Uttoxeter, Staffs.
Waters, Edward...Arminghall, Norwich
Waters, Henry...Sutton, Seaford, Sussex
Waters, Robert...Boscombe, Amesbury, Wilts
Waters, R. S...St. Giles's, Cranborne, Dorset
Waters, Thomas...Stratford Sub-Castle, Salisbury
Waters, Wm...Wighton, near Walsingham, Norf.
†Watkins, John Gregory...Woodfield House, Ombersley, near Worcester
Watkins, Col. L. V., M.P....Pennoyre, near Brecon
Watkins, Samuel...Forest Hill, near Worksop, Notts
Watkins, Sober...Bodrhyddan, St. Asaph, N. W.
†Watkins, Wm....Ombersley, Worcester
Watson, B. F....16, Cambridge Terrace, Hyde Park
†Watson, C. W....Wratting Park, Linton, Cambs.
Watson, George...Willingham, Fakenham, Norfolk
Watson, H. G....123, George Street, Edinburgh
†Watson, James...Thorney, near Peterborough, Northamptonshire
Watson, James...Wouldby, near Hull, Yorkshire
Watson, John...Bolton Park, Wigton, Cumberland
Watson, John...Kendal
Watson, Capt. Wm....New Place, Acacia Road, St. John's Wood
Watson, W. C...14, Great Cumberland Place
Watts, James...Hythe, Kent
Watts, Robert...Battle, Sussex
Watts, William...Scaldwell, Northampton
Wavell, Wm....Rookley Farm, Blackwater, Isle of Wight
Wayne, T. M...Manor House, South Warnborough, Odiham, Hampshire
Weall, Thos...Woodcote Lodge, Beddington, Surrey
Webb, Daniel C....Hethe, Bicester, Oxon
Webb, George...Beaumont Hall, near St. Albans, Herts
Webb, Humphrey...Orslow, near Newport, Salop
Webb, John...Horseheath, Cambridgeshire
Webb, J. C...Hempnall, Stratton St. Mary, Norfolk
Webb, Jonas...Church Farm, Babraham, Cambridge
Webb, Samuel...Babraham, Cambridge
Webb, Thomas...Hildersham, Cambridge
Webb, Theodore V...Clare Hall, Cambridge
Webb, Rev. Wm...Master of Clare Hall, Cambridge
Webb, William...Haselor, Tamworth, Staffs.
Webb, William...Clownholme, Rocester, Staffs.
†Webber, Chas. H...Buckland, Barnstaple, Devon
Webber, Samuel...Ipswich
Webber, Thos....Halberton Court, Tiverton, Devon
Webber, Wm....Tonbridge, Kent
Webster, Baron Dickinson..Penns, nr. Birmingham
Webster, Frederick...Marley Farm, Battle Abbey, Sussex
Webster, James...Peakirk, Market Deeping, Lincolnshire
†Webster, J. Philip...Heath and Reach, Leighton Buzzard, Bedfordshire
Webster, Thomas...Kendal, Westmoreland
Webster, W. B....Houndsdown, near Southampton
Wedd, Octavius...Foulmire, near Royston, Cambridgeshire
Wedge, Charles...Hornwood Farm, Meridan, near Coventry
Wedge, Francis...Badminton, Tetbury, Gloucesters.
Wedlake, Mrs. Mary...Hornchurch, Essex
†Weeding, Thomas...47, Mecklenburgh Square
Weeks, Frederick...8, London Road, Brighton
Weeks, R. M...Ryton Park, Newcastle-on-Tyne
Welbank, Captain...Tandridge Priory, Godstone
Welch, Alfred...Southall, Middlesex
Welch, Jno..Bachymbyd Back, Ruthin, Denbighsh
Welchman, Robt. Frederick..Southam, Warwicksh.
Weld, Edw. J...Tavistock Court, Barnstaple, Devon
Weld, Joseph...Lulworth Castle, Dorset
Welfitt, Wm. T...Manby Hall, Louth, Lincolnshire
Welford, R. G...Northaw, near Barnet, Middlesex
Weller, Richard...Capel, Dorking, Surrey
Wellingham, E...Walton, Lynn
Wellings, Thomas...Muckleton, near Shrewsbury
Wells, Charles...Ware, Herts
†Wells, John...Armyn, Booth Ferry, Yorksh.

Wells, John...Woodborough, near Nottingham
Wells, Thomas...Hampnett, Northleach, Glouc.
Welman, C. Noel...Norton Manor, Taunton
Welsh, William...Leake, Boston, Lincolnshire
Welstead, Benjamin...Kimbolton, Hunts
Wemyss, Major-Gen...Cumberland Lodge, Windsor Park
Wentworth, Godfrey...Woolley Park, Wakefield, Yorkshire
West, Desaguliers...Water House, near Bath
West, Capt. Henry, R.N....Jesmond, near Newcastle-on-Tyne
West, John...Miningsby, near Spilsby, Lincolns.
West, J....Melton Ross, Brigg, Lincolnshire
West, Wm. H....Gliffaes, Crickhowell, Brecknocks.
Westbury, Giles...Andover, Hampshire
†Westcar, Henry...Burwood Cottage, Esher, Surrey
Westcote, John Baker...Coate, Martock, Somerset
†Western, Thomas B...Felix Hall, Kelvedon, Essex
Westminster, Marquis of .... Motcombe House, Shaftesbury, Dorset
†Weston, James, jun. ....Stoneleigh, Coventry, Warwickshire
†Weyland, John....Woodrising Hall, Hingham, Norfolk
Weyland, Richard...Woodeaton House, near Oxford
Whaley, J....Holly Hill, Enfield, Middlesex
Whalley, Charles Lawson...Lancaster
Whalley, Capt. G. B....Birdlip, near Painswick
Whalley, Robert...Brantham Hall, near Manningtree, Essex
†Wharncliffe, Lord...Wortley Hall, Sheffield
Wharton, Rev. Fitzwm. Wm....Barningham Rectory, Richmond, Yorkshire
Wharton, Francis...Dunscroft, Hatfield, near Doncaster, Yorkshire
Wharton, Rev. James Charles...Gilling Vicarage, near Richmond, Yorkshire
†Wharton, John Thomas...Skelton Castle, Guisborough, Yorkshire
Wheatley, Matthew...Shieldfield, Newcastle-upon-Tyne
Wheble, Edmund...27, Upper Montague Street, Montague Square
Wheble, J. J....Bulmarsh Court, Reading
Wheeler, John...Trippleton, Leintwardine, Ludlow, Shropshire
Wheldon, Stephen...Pelton, near Chester-le-Street
Whetham, Major-Gen....Kirklington Hall, Southwell, Notts
Whieldon, Geo....Springfield House, near Coventry
Whincup, Francis...Ketten, near Stamford
Whistler, John...Brancaster, Norfolk
Whitaker, Rev. Geo. A....Knodishall, near Saxmundham, Suffolk
Whitaker, Joseph...Ramsdale House, Nottingham
Whitaker, Joshua...Bratton, Westbury, Wilts
Whitbread, John...Hazlewood Farm, Edmonton
†Whitbread, Samuel Charles...22, Eaton Place
Whitby, Mrs. Mary A. T....Newlands, Lymington, Hampshire
†White, Alg. Holt ...Sewald's Hall, Harlow, Essex
†White, Henry...Warrington, Lancashire
White, James...Yaverland Farm, Isle of Wight
White, John....Parsonage Farm, Rickmansworth, Hertfordshire
White, John B....Little Bedwyn, near Marlborough
White, J. H....Chevening, near Sevenoaks, Kent
White, John Mould...Mickleover, Derby
White, Joseph...Ampfield House, Romsey, Hants
White, Richard...Prior Halton, Ludlow, Shropshire
White, Richard...Norwich
White, R. Edward...Aspley Guise, Woburn, Beds
White, Thomas ...Elly Hill, Houghton-le-Skerne, Darlington
White, Thos....Kenward, Yalding, Kent
White, Wm....63, Beaumont Square, Mile End
Whitehead, John...Barnjet, West Barming, Maidstone
Whitehead, John...Preston
Whitehead, Richd...West Farleigh, Maidstone, Kent
Whitehouse, Wm....Exchange Buildings, Liverpool
Whitgreave, G. T. ..Moseley Court, Wolverhampton
Whiting, John...Heston, Hounslow, Middlesex
Whiting, T. S....Codford St. Peter's, Wilts
Whitlock, Francis...Lovingtons, Great Yeldham Halstead, Essex
Whitmell, John..Crick, Daventry, Northamptonsh.
†Whitmore, Thos....Apley Park, Bridgnorth, Salop
†Whitmore, Thos. C....Apley Park, Shiffnal
Whitmore, W. W....Dudmaston, Bridgnorth, Salop
Whittaker, Oldham...Hurst House, Ashton-under-Lyne
Whittam, James Sibley...Cowndon, Coventry
Whitter, William...Worthing, Sussex
†Whitting, Wm.....Thorney, near Peterborough Northamptonshire
Whittle, Edward...Toller Fratrum, Dorchester
Whitton, Corbett...Stafford
Whitworth, H. B....Northampton
Whitworth, Joseph....Chorlton Street, Portman Street, Manchester
Whitworth, Wm....Earl's Barton, Wellingborough
Whybro, Edward...Tottenham Green, Middlesex
†Wickens, James Stephens...35, Mortimer Street
Wickham, Edward...St. Margaret's, Rochester
Wickham, James...Sutton Scotney House, Andover Road, Hampshire
Wickham, John...Butcombe, near Shepton Mallet, Somersetshire
†Wicksted, Charles...Shakenhurst, Cleobury Mortimer, Salop
Widdicombe, John...Ladbrook Cottage, Ugborough Devon
Widdrington, Capt. (R.N.)..Newton Hall, Alnwick Northumberland
Wiffin, William...Crabs Castle, Wells, Norfolk
Wigan, Edmd. ..Lapley Breewood, Wolverhampton
Wigg, Wright...South Green, East Dereham, Norf'k
Wiggins, John...Tyndale, near Danbury, Essex
†Wight, James...Tedstone Court, Bromyard, Herefordshire
Wigney, Thomas Jennings...Huddersfield
Wilberfoss, Thomas...Wetwang, Driffield, Yorkshire
Wild, S. Bagnall....Costock, near Loughborough Leicestershire
Wild, Thos. Martin...Branbridges, East Peckham Tunbridge, Kent
Wilde, George...1, Cambridge Square, London

Wilding, Charles...Powis Castle, Welshpool
Wilding, James...High Ercal, Wellington, Salop
Wiley, Joseph...Sprowston, Norwich
Wiley, Samuel...Bransby, near York
Wilkin, Charles...Tolleshunt Knight, Kelvedon, Essex
Wilkin, Charles...Twerton, near Bath, Somerset
Wilkins, Henry...Westbury-on-Severn, near Gloucester
Wilkinson, Geo. H....Harperly Park, Durham
Wilkinson, H. J....Walsham-le-Willows, Ixworth
Wilkinson, J. Etridge...Dunston Lodge, Gateshead
Wilkinson, O. R....Eaton Socon, St. Neots, Hunts
Wilkinson, Percival Spearman....Furze House, Leamington
Wilkinson, Thomas..Chawton, Cowes, Isle of Wight
Wilkinson, Thomas Aytown...Dringhouses, York
Wilkinson, Capt. T. H....Walsham, near Ixworth, Suffolk
Willes, George...Hungerford Park, Hungerford
Willes, William...Fritwell, Brackley, Northamptonshire
Williames, J. B....Glan Hafren, Montgomeryshire
Williams, Alf. Edw....West Mersia Hall, Colchester
Williams, Major Arthur Charles...Eaton-Mas-Caul, Shrewsbury, Salop
Williams, Charles...Torquay, Devonshire
Williams, Rev. Charles...Gedling Rectory, near Nottingham
Williams, C. C...Roath Court, Cardiff, Glamorgansh.
Williams, Cyril...Falcymeran, Pwllheli
Williams, Edward...Tre-beirrd, Mold, Flintshire
Williams, Edward...Lowes Court, near Hay, Herefordshire
Williams, Evan...Rhayader, Radnorshire
Williams, Evan...Aberyskir, near Brecon, S. W.
Williams, Fras. E....Doddenham, near Worcester
Williams, G. M....Brocklesby, Great Limber, Lincolnshire
Williams, Herbert...Stinsford House, Dorchester
Williams, H. Lloyd...Llanfillyn, Oswestry
Williams, Hugh...Kineton, Stratford-on-Avon
Williams, Rev. James..Llanfair-yn-Nghornwy Rectory, Anglesey
†Williams, James...Northcourt, near Abingdon
Williams, John...Bank, Chester
Williams, John...The Grove House, Denbigh
Williams, John...Buckland, Faringdon, Berkshire
Williams, J. A....Baydon, Hungerford, Berkshire
Williams, Leigh...Castle Hill, Farnham, Surrey
Williams, Martin...Bryngwyn, Oswestry
Williams, Matthew Davies....Cwmcynfelin, near Aberystwith, S. W.
Williams, Peter...Siamberwen, Anglesey
Williams, Rees...Maesgwyn, Neath, Glamorgansh.
Williams, Rees...Manest Court, near Brecon
†Williams, Robert, jun....Bridehead, Dorchester
Williams, Rev. Thos....Fir-y-cwm, Ystrad, Swansea
Williams, Thomas...Bryn, Beaumaris, Anglesey
Williams, Thomas...Brecon, S. W.
Williams, William...Skethrog, near Brecon
Williams, Wm....Tregulloa, near Truro, Cornwall
Williams, Wm....Aberpergwyn, Neath, Glamorgsh.
Williams, Wm....High Street, Bedford
Williams, Wm. Adams....Llangibby Castle, Usk, Monmouthshire
†Williamson, Hugh Henshaw...Greenaway Bank, Burslem, Staffs.
Williamson, Isaac...East Orielton, near Pembroke
†Willich, Chas. M....24, Suffolk Street
Willis, Jos., jun...Bucknowle, Corfe Castle, Dorset
Willoughby, Edward...Birkenhead
†Willoughby, W....
Wills, John...South Petherwyn, Launceston
Wilmer, Wilmer...4, Elm Court, Temple
Wilmot, Sir Hy. S., Bart....Chaddesdon Hall, near Derby
Wilmot, Rev. Rich. Coke...Neswick Hall, Baynton, Beverley, Yorkshire
Wilson, Ashley Henry...The Abbey, Wigton
Wilson, Edward...Rigmaden Park, Kirby Lonsdale, Westmoreland
Wilson, George...Dallam Tower, Milnthorpe
Wilson, Geo. Edwd....Ilmersham, Milnthorpe
Wilson, Geo. St. Vincent...Redgrave Hall, Botesdale, Suffolk
Wilson, Henry Corbett...Southam, Warwickshire
†Wilson, Hon. Henry W....Keythorpe Hall, Tugby, Leicestershire
Wilson, Capt. John...The Howe, Kendal
†Wilson, Joseph...Highbury Hill, Islington, Middx.
Wilson, Matthew, jun....Eshton Hall, Skipton, Yorkshire
†Wilson, Richard Bassett...Cliffe House, Darlington
†Wilson, Hon. and Rev. Robert...Ashwell-Thorpe, Wymondham, Norfolk
Wilson, Robert...South Shields
Wilson, Robert...Yarm, Yorkshire
†Wilson, Thomas...Shotley Hall, Newcastle-upon-Tyne, Northumberland
Wilson, Thomas Francis...123, Fenchurch Street
†Winchester, The Marquis of....Amport House Andover
Winder, J. W. Lyon...Vaenor Park, Welshpool, Montgomeryshire
Wing, Tycho...Thorney Abbey, Peterborough
Wingfield, John...Onslow, Salop
Wingfield, John M....Tickencote Hall, Stamford, Lincolnshire
Wingfield, Richard Baker...2, Lowndes Square
Wingfield, William...91, Eaton Square
Winn, Rowland...Appleby Hall, Brigg, Lincolnsh.
Winnall, John...Newland, near Worcester
Winnall, Thomas...Eccleshall Court, Lea, Ross, Herefordshire
Winnington, Sir Thomas, Bart...Stanford Court, Worcester
Winns, Thomas...Lincoln
Winsor, George...Sarratt, Rickmansworth, Herts
†Winterbottom, James Edwd....East Woodhay, near Newbury, Berkshire
Winthrop, Rev. Benjamin...Clifton, Bristol
Wippell, John...Exminster, Devonshire
†Witney, William...26, Conduit Street
Witt, Edward ... Fornham All Saints, Bury St. Edmunds

Witt, Matthew...Waterbeach, near Cambridge
Witt, Samuel...Swaffham, Cambridge
Wittingstall, E. F. ...Langley Bury, Watford, Herts
Wodehouse, Edmund, M.P....Thorpe, near Norwich
†Wodehouse, Lord...Kimberley, Wymondham
Wolfe, R. Birch...Wood Hall, near Newport, Essex
Wollaston, Major Fred...Sheepy Magna, Atherstone
Wollen, Joseph...Wedmore, near Wells, Somerset
Wood, Arthur W....Littleton, Chertsey, Surrey
†Wood, Rt. Hon. Sir Charles, Bart., M.P....Ickledon Hall, Doncaster, Yorkshire
Wood, Charles...Langford Hall, Maldon, Essex
Wood, Charles...Siddington, Cirencester, Gloucestershire
Wood, Edward A....Osmington, near Weymouth
Wood, G...Denver, near Downham Market, Norfolk
Wood, George...South Dalton, Beverley, Yorkshire
Wood, George...Hanger Hill, Ealing, Middlesex
Wood, Geo. J....Admiston Hall, Blandford, Dorset
Wood, Henry...Ovingdean House, Brighton
Wood, Henry..Woolgarston, near Penkridge, Staffs.
Wood, James....Ockley, Hurstperpoint, Sussex
Wood, Rev. John...Swanwick Hall, Alfreton, Derbyshire
Wood, John...Croham Farm, Croydon, Surrey
Wood, John...Melton, near Woodbridge, Suffolk
†Wood, John...Excise Office, London
Wood, John...York
Wood, Sir J. P., Bart....Glazenwood House, near Braintree, Essex
Wood, Nicholas...Killingworth, Newcastle-on-Tyne
Wood, Rev. Richard...Woodhall Park, Leyburn, Bedale, Yorkshire
Wood, Richard...18, Temple Row, Birmingham
Wood, Thomas...Grendon, Atherstone, Warwicksh.
Wood, Rev. W....Martock, Somerset
Wood, Wm...Gopsall House, Twycross, Leicestersh.
Wood, Capt. W. Mark...5, Audley Square
Wood, Willoughby...Campsall, Doncaster
Woodall, Henry...Beverley, Yorkshire
Woodcock, Hy. C....Buntingley, Melton Mowbray, Leicestershire
Woodcock, John G....Breston, Dereham, Norfolk
Woodd, Basil Thomas...Thorpe Green, Boroughbridge, Yorkshire
Woodham, Rev. Thos. F....Winchester, Hampshire
†Woodham, William Nash...Shepreth, Melbourne, Cambridgeshire
Woodhams, W. R....Hammonds Udimore, Rye, Sussex
Woodhouse, John...Over Seale, Ashby-de-la-Zouch
Woodley, Matthew..Benfield Bury, Stanstead, Essex
Woodman, Henry..Stitchcombe, Marlborough, Wilts
Woodman, Richard, jun....Glynde, Lewes, Sussex
Woodrow, Wm. Robberds...Tombland, Norwich
Woods, Henry...Merton, Thetford
Woods, Richard...Osberton, near Worksop, Notts
†Woods, W. Leyland...Chilgrove, near Chichester
Woodward, Francis...Little Comberton, Pershore, Worcestershire
Woodward, Jos...Birlingham, Pershore, Worcestsh.
Woodward, Robert...Liverpool
Woodward, Robert...Rise Hall, Akenham, Ipswich
Woodward, Wm....Bredons Norton, Tewkesbury, Gloucestershire
†Woodyeare, Rev. J. F. W....Crookhill, Doncaster
Wooldridge, Henry...Meon Stoke, Bishops Waltham, Hampshire
Wooldridge, J. W....Webb's Land, Wickham, Hants
Wooldridge, Rich...Titchfield Park, Fareham, Hants
Woolfe, Joseph...Haslington Hall, Crewe, Cheshire
Woolley, T. Smith, jun....North Collingham, Newark, Notts
Woolrich, Abraham...Little Ness, Shrewsbury
Worledge, W....Creeting, near Stowmarket, Suffolk
Worlledge, John...Ingham, near Bury St. Edmunds, Suffolk
Worsley, Chas. Cavill...Platt, near Manchester
Worsley, Rev. P. W...Little Ponton, near Grantham
Wortham, Biscoe Hill...Royston, Herts
Worthington, Archibald...Whitchurch, Salop
Worthington, Isaac Jackson...Whitefield Cottage, Lymm, Warrington
Worthington, Jonathan...Moorhill House, Stourport, Worcestershire
Worthington, Richard...Saddington, Market Harborough
Worthy, Samuel....Temple Coombe, Wincanton, Somersetshire
Wortley, N. W...Ridlington, Uppingham, Rutland
†Wratislaw, Wm. F....Rugby, Warwickshire
Wray, John...6, Suffolk Place, Pall Mall East
Wren, Adderley Bacton ... Lenwood, Bideford, Devon
Wren, Wm. Weld...East Wood, Bury, Rochford, Essex
Wren, Wm. Weld, jun....73, Gower Street
Wrench, Samuel...Great Holland Hall, Colchester
Wrey, Sir Bouchier, Bart....The Chase, Ashburton, Devon
†Wright, Charles...Bilham House, near Doncaster, Yorkshire
Wright, Charles...Worsborough, near Barnsley, Yorkshire
Wright, David...Hepworth, Ixworth
Wright, Edmund...Halston, Oswestry
Wright, Francis...Osmaston Manor, Derby
Wright, Henry...Kelvedon Hall, Brentwood
Wright, James...Blyth, North Shields
Wright, James...Ravenhill, near Rugely, Staffs.
Wright, John...The Terrace, Chesterfield, Derbysh.
Wright, John, jun....Buxton, near Norwich
Wright, Robert ..The Close, Norwich
†Wright, Thomas...North Runcton, Lynn
Wright, Thos. Poyntz...Stuckeridge House, Bampton, Devon
Wright, Wm....Gresford Bank, near Wrexham
Wright, Wm....Fring, Rougham, Norfolk
†Wrightson, W. Battie, M.P...Cusworth Park, Doncaster
Wroughton, Philip...Ibstone House, near Stokenchurch, Oxon
Wyatt, Osmond Arthur...Troy House, near Monmouth
Wyatt, Harvey...Acton Hill, near Stafford
Wyatt, Hugh...Cissbury Findon, Shoreham, Sussex

Wyatt, Hugh Penfold...Cissbury Findon, Shoreham, Sussex
Wyatt, James...Limegrove, Bangor, Carnarvonshire
Wyatt, John...Nutbourne, Emsworth, Hampshire
Wyatt, T. H....Heythrop, near Enstone, Oxon
Wyatt, William...Eyam, Bakewell, Derbyshire
Wyld, John Hopton...Bristol
Wyld, William Hopton...Bristol
Wyles, Thomas...Little Ponton, Grantham, Linc.
Wyley, James...High Onn, Stafford
†Wyley, James, jun....Longdon, Lichfield, Staffs.
†Wyley, Wm....Vineyard, near Wellington, Salop
†Wyndham, J. E....Fairburn House, Acton Green, Middlesex
Wyndham, J. H. C....Carhampton House, Bishops Waltham
†Wyndham, Wm....Dinton, Salisbury, Wiltshire
Wynne, John Lloyd, jun....Coed Coch, Abergele, Denbighshire
Wynne, Brownlow Wynne...Garthewin, Abergele, Denbighshire
Wynne, Rich. Lifton...Astrad, near Denbigh
Wynne, Wm. W. E....Mount Sion, Oswestry
Wynniatt, Rev. R....Guiting Park, Winchcombe, Gloucestershire
Wyvill, Rev. Edward...Fingal, Bedale, Yorkshire

Yeates, James...High House, Stainton, near Kendal, Westmoreland
Yeates, John Yeates...Park-head, Levens, Milnthorpe, Westmoreland
Yeatman, Harry Farr...Marston House, Blandford, Dorset
Yeld, Thomas...The Broome, Leominster
Yeo, Wm. Arundell...Fremington House, Barnstaple, Devonshire
Yorke, Hon. Eliot Thos., M.P...Wimpole, Arrington, Cambridge
Yorke, Joseph...Forthampton Court, Tewkesbury, Gloucestershire
Young, Allen A...Orlingbury, nr. Wellingborough
Young, George...Shrewsbury
Young, Wm...Yarlington, Castle Carey, Somerset