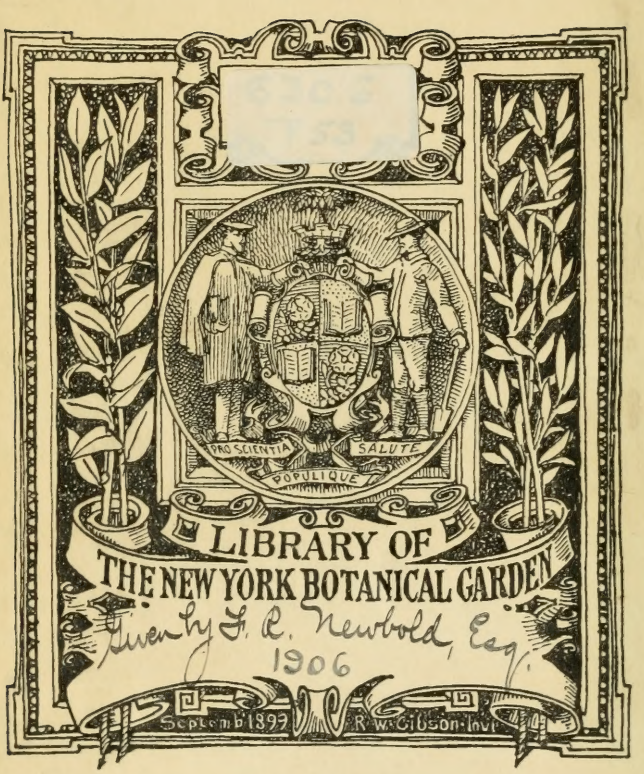
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MEMOIRS

OF THE

PHILADELPHIA SOCIETY

FOR PROMOTING AGRICULTURE.

CONTAINING

COMMUNICATIONS ON VARIOUS SUBJECTS

IN

HUSBANDRY & RURAL AFFAIRS.

TO WHICH IS ADDED,

A STATISTICAL ACCOUNT

OF THE

SCHUYLKILL PERMANENT BRIDGE.

VOL. I.

"Let us cultivate the ground, that the poor, as well as the rich, may be "filled; and happiness and peace be established throughout our borders."

Tentanda Via est, qua nos quoque possimus tollere Humo:——

PHILADELPHIA:
PRINTED BY JANE AITKEN, No. 71,
NORTH THIRD STREET.
1808.

PREFACE.

THE PHILADELPHIA SOCIETY FOR PROMOTING AGRICULTURE, was formed in the year *one thousand seven hundred and eighty five*, by some citizens, only a few of whom were actually engaged in husbandry, but who were convinced of its necessity; and of the assistance which such an association, properly attended to, would afford to the interests of agriculture. The society continued to meet regularly, for several years;--and published numerous communications from practical men, in the news papers of the day, on various interesting subjects; and thereby contributed to diffuse the knowledge of many improvements in agriculture; the general adoption whereof, has visibly tended to increase the product, and to improve the qualities of the soil of Pennsylvania.

The continuance of a long war with Great Britain had effectually precluded all friendly intercourse, and prevented the receipt of all information from that country, (in a language generally understood here) not only of the improvements in agriculture there existing, but of those in other European countries, wherein the practice and principles of good husbandry are universally attended to. The system generally pursued here at that time, was bad in the extreme. It consisted in a series of exhausting grain crops, with scarcely any interruption, for several years; after which, the land was abandoned to weeds and natural grass, under the fallacious idea of rest; and, when completely worn out, new land was cleared,

and the same wretched system pursued. A natural meadow, or one artificially watered, supplied more or less of hay; but where these resources were wanting, the purchase of winter fodder was made from the hard earnings and savings in other products; or the poor animals fed on straw, and the scanty pickings in the fields.—Since the introduction of *red clover*, and other *artificial grasses*, a great and obvious change has taken place; and the most beneficial consequences have followed. The comforts of the farmer are greatly increased, and abundant supplies of summer and winter food for all domestic animals, are furnished. Thus, by the manure obtained, ample means are afforded, of renewing the original strength of the soil. Among other measures tending to produce this happy alteration, the general use of *gypsum* may be mentioned, as one of the most important: for although this substance had been introduced many years before the date of our institution, yet its use was chiefly confined to the vicinity of Philadelphia. The society reflect with patriotic pleasure, upon their agency in diffusing more extensively the knowledge of its effects upon land; and in assisting to dispel the prejudices which unfortunately prevailed against it, by the publication of the communications of practical men, containing the result of their experience with that valuable substance.*

Premiums were also proposed and conferred, for the elucidation of subjects upon which information was required, for the adoption of approved systems and modes of European culture, and practices, and for the improvement of certain articles of domestic manufacture. Among the latter, *cheese* may be mentioned; for the best sample of which, and greatest quantity, a gold medal was presented to Mr. *Mathewson of Rhode Island*, in the year 1790; the consequence of this distinction

* The reader is referred to the concise and useful publication of our now President, in 1797, upon the subject of *gypsum*, for a full account of its use as a manure; and a refutation of the various prejudices formerly urged against it.

by the society, was a laudable competition among dairy men, and an increased demand, owing to the striking improvement, in the quality of the article, and a rise in price, so as amply to reward, and extend the manufacture, and in a great degree, preclude the necessity of importation. At the present day no occasion exists, for the importation of *cheese* from *Europe*, for general consumption, or as an indispensable supply. Importations on a less scale, continue to be made, but these are in a small proportion to the quantity produced, and manufactured from our own dairies.

After several years of active exertions, the society was unfortunately permitted to fall into a long sleep; but was again revived, in the winter of 1804, and now holds regular meetings. New subjects for premiums have been proposed, as will be seen by the present volume, and have been several months in circulation: numerous communications have been received; from which those now published, are a selection; and some papers before published are added; as being thought worthy of preservation, in our collection. As it is the wish of the society to pursue its labours, with all the zeal due to the importance of the object, for which it was instituted, the communications of all practical agriculturists, upon whose support the usefulness of the Society will in a great measure depend, are earnestly solicited. The example being once set, will be followed by others; and thus, a body of information will be collected; which may essentially benefit the country. The pursuits of the industrious farmer, being more of a practical than a literary nature, he may be induced to think that he is not qualified to give a written account of his improvements, but let not such be backward. The Society are in want of facts, and they care not in what stile of language they are communicated. *Criticism* is missapplied, and out of place, on such occasions. The communications of philosophical and literary characters, on any points contributory to the elucidation of sub-

jects connected with agriculture,* will be highly beneficial and gratifying.

Two subjects, in particular, are deemed worthy of great attention, from all concerned in agriculture; and on these the society would gladly receive information: viz. *on the diseases of our domestic animals, and, on new manures;* on both these subjects, very interesting papers will be found in the present volume. A great object in American husbandry, is the improvement of *horned cattle:* the society will therefore receive, with thanks, all information respecting any domestic breeds of neat cattle, sheep, and swine, which have been found to possess peculiar good qualities: and they strongly urge the necessity of preserving, for breed, all those, even of accidental offspring, possessing the desirable and requisite qualities, to entitle them to value and preference. Thus a breed of neat cattle, producing oxen, remarkable for speed of gait and strength, symmetry of form, and gentleness of disposition; and a tendency to fatten quickly, and to increase of flesh and fat, upon those points which recommend them at market, are to be attended to. It is well known, that the diversity in these respects is great, and constitutes the ground of important improvements, by various spirited farmers in *Europe*. And as in many parts of this country, occasional instances of very excellent breeds are to be found, the society think they will render service to the community, by calling the public attention to the subject. It must be acknowledged that the common American oxen fatten well, that they

* Many citizens have a mistaken idea, that their not being *agriculturists*, disqualifies them from becoming useful members of our Society. A contribution of pecuniary means, and personal patronage, are the first requisites, in our plan, for promoting the prosperity of this great City, by diffusing and encouraging the knowledge and pursuits of agriculture. The interests of *Commerce*, *Arts* and *Manufactures*, form, with *Agriculture*, an indissoluble union; to which citizens of every class and calling, have it amply in their power to contribute.

grow to immense sizes; and that as fine samples of beef, are every day to be met with in the markets of *Philadelphia*, as in any other part of the world. But as respects cows, we are much deficient,* a circumstance which is the more to be regretted, as probably in no country, does the article of butter, yield greater profit than in the *United States*. Some attempts have indeed been made, to improve our stock, by the importation of bulls and cows, particularly in Maryland and New York; but the public generally, are not yet informed of the success, which has attended the experiment; and whatever may be the result of imported brood animals, the great price at which they must necessarily be held, to remunerate the concerned, for the heavy expences of importation; will prevent the desired benefit from being speedily or generally derived from them. This circumstance ought to operate as an additional reason, for a careful selection of the most valuable animals from our domestic stock, and for the preservation of such others as we may occasionally meet with.

With respect to *sheep*, the objects to be attended to are in part common, with those first noted as to *oxen*. Within a few years, large sizes were chief objects of attention in *England;* but repeated experiments have shown, that they are not so profitable, as those of a moderate size.

The fortunate introduction of the *Spanish*, *English*, and *Barbary sheep*, all of which are now spreading through the middle States, may be considered as important acquisitions to the agricultural interest. With regard to the *Spanish sheep*, it is found by years of experience, that the cross with *Ame-*

* *In Holt's* agricultural survey of the county of *Lancashire*, a plate is given of a cow, which, as a pattern of excellence and model of perfection, was said to have been sent some years since to America. The place unfortunately, is not mentioned. Three years since, information respecting this cow, was sought for by advertisements in news papers; and although the request was universally circulated, no intelligence was obtained respecting her.

rican ewes produces a healthy, hardy, gentle race, which fatten more speedily than the pure *American* blood; do not loose their wool, when shearing has been neglected beyond the usual time, and do not become diseased when fat. The fine quality of the wool is known to all the world; and what is of great consequence, the weight of *fleece* of the cross with *American* ewes, is evidently increased, when compared with the imported sheep. The same increase takes place in the cross with the English sheep. It may be well to add, that the wool of sheep from the *Spanish* cross, exhibits the most evident marks of improvement; this adds another proof to the many which all parts of the world furnish,* that the prejudice respecting the peculiar nature of the climate of *Spain*, being exclusively calculated to produce fine wool, is erroneous.

We owe the introduction of the Barbary mountain sheep, with broad tails, to our gallant countryman, William Eaton, who, when Consul at Tunis, sent them in an armed vessel in the service of the United States, commanded by Henry Geddes, to Timothy Pickering then secretary of state, who presented a fine ram and ewe to the President of our society, from whose disinterested zeal, this valuable breed is now spreading through the State of Pennsylvania, and other States in its immediate vicinity. The wool of those sheep, owing

* Mr. Lasteyrie in an extensive tour, made with the express purpose of ascertaining the fact of the congeniality of various climates to fine wool, found that the climate of Holland, though damp, does not prevent the breed of the Spanish sheep from thriving. He saw the fourth generation of these animals, bred in the country, which had as fine wool as the Spanish sheep, though both the soil and the climate, were in appearance very unfavourable to the constitution of those animals. In Denmark and Sweden, and even in the most northern parts of those two countries, that breed has existed without degenerating for many years. He adds that a few years since, the Danish Government, sent for 300 Spanish sheep, and that only one died in the course of two years, notwithstanding a very severe cold happened the year after they arrived.

to their health and vigour, does not fall off, like the fleeces of those meagre and degenerate runts, which are too frequent here; it is moreover, in general, of a good staple, and next the skin, peculiarly soft and furry. The weight of the sheep is above mediocrity, but their chief excellence arises from their hardihood, and disposition to fatten speedily; a quality they possess in a remarkable degree, which causes them to be highly valued, both by the grazier and butcher. Hatters, who are acquainted with it, prefer it, for their manufacture, to any other wool. It spins free, and to any fineness. Flossy, fine and well dressed cloth, has been made of it. Those who have worn fleecy stockings, and gloves, of this wool, speak of it with great approbation. Perhaps a cross with the *Merino*, would benefit both.

We possess several valuable breeds of swine; but none, except the *Chinese* and *African* breeds, are distinctly marked. Both these breeds are remarkable for fattening speedily, but their deficiency of flesh, lessens their value, when preserved pure. They both therefore answer best when crossed with our native breeds; as their progeny take on a disposition to diffuse the fat through the flesh, which is also increased; instead of being laid thick on the outside. The Chinese hogs are very prolific, but have thick skins, and therefore not so profitable or delicate for roasters as the African breed, which have remarkably thin skins: these latter will weigh ten pounds at the age of four weeks, and will then bring one dollar twenty five cents at market.

If we have not published all the communications with which we have been favoured, it is not owing to a want of respect for them, or their authors. But our means are yet limited; and our society is only emerging from a state of torpor, into which past circumstances had thrown it. We selected *subjects* rather than *essays;* and risk this recommencement of our well meant endeavours, to promote the happiness and prosperity of our country, with no motive either of personal fame,

or interest. Should this attempt be favourably received, and our exertions adequately supported; we have strong hopes, that the usefulness of our association will be extensively experienced. We cannot be disappointed in the satisfaction we feel in having made an effort, to attain a desirable object, however feeble, it may be found, as it respects us in its means, or result. It will at least set an example; and invite men of talents and practical experience, to add to our scanty stock of knowledge, on the important subject of our institution. Those who have enabled us, by their communications, to fulfil our wishes, in the objects we endeavour to attain, merit and receive our sincere acknowledgments; and we are persuaded, have entitled themselves to the grateful attention of those, whose interests they are calculated to promote. It is equally useful to us, to be supplied with information, either new or not generally known here; whether it be obtained by those who impart it, from reading, travel, or original thoughts or practice. As other countries receive the benefits of our labours, in the products supplied to them, through the channels of an extensive and prosperous commerce, it is fit that we should profit by their experience in the arts of cultivation; by which those products will be brought forth more advantageously to us, and beneficially to them, both in quality and abundance. Those who introduce among us, the improvements of foreign countries in agriculture, and the arts and sciences with which it is intimately connected, effect a reciprocity of accommodation. It depends on the good sense and practical attention of our farmers, to adapt them to our climates, soils, habits, and actual circumstances. All foreign practice or improvement, will not suit our situation. We cannot furnish labour, or afford expence, beyond a certain point; but the principles will apply in all countries, and when they are developed, in a plain and intelligible manner, they may, in a greater or less degree, be practiced upon, and fitted to the actual state of things here,

so as to produce incalculable and permanent advantages. Although much benefit has been, and will continue to be derived from *European* models, and examples in husbandry; it is with pleasure we observe, that from our own resources, we grow more and more independent of foreign aid. The knowledge of both principles and practice in *agriculture*, is daily increasing; and the general mass of agricultural improvements is evidently advancing throughout our country. Nothing will more conduce to the attainment of the great object of those, who desire to promote this most essential of all arts, than associations to receive and communicate information, on this important subject. Let these be devoted entirely to agricultural enquiries and pursuits; and avoid all topics which are productive of dissension, and calculated to withdraw their attention from the objects of common concern. A small collection of *Books* and *Models*, are attainable at little expence, with some judicious attention in the choice of them. These will be sources of information and useful amusement, as well as cements of union, and means of gaining and diffusing knowledge, auxiliary to practice. A community of interests, may be thus established; mutually supporting and supported, informing and informed; and nothing contributory to the benefit of the whole, will be omitted or lost. Public aid has been so often sought in vain, that private exertions must be redoubled. To this end, a zeal for agricultural knowledge, and practical improvements, must be rendered fashionable, that it may become general and characteristic. Those who seek for personal distinction in our government, and those who from disinterested and virtuous inclinations, perform duties the most honourable to themselves, and beneficial to society; will find the most solid *popularity* and *durable fame*, in measures promotive of the interests (always inseparable from those of commerce and the arts) of agriculturists; who compose the great body of the people. This will shew itself in public improvement;

in which the efforts of individuals will be aided and cherished by legislative patronage, and pecuniary support. Our state will then hold its proper rank among our neighbours; and our natural and local advantages, remain no longer inactive. Roads and inland navigation, will be primary objects of legislative attention. The arts of husbandry will be assisted, supported, and rewarded: public men will be popular and eminent, in proportion to the services they render to the leading interests of their country. These, most assuredly, are those of agriculture, and the arts and sciences, all of which are intimately, and indissolubly connected. Our eyes will then be opened, to the sources of wealth and prosperity, which are properly our own; easily attainable, ample, and inexhaustible: and it will no longer be left to the discernment of the intelligent in rival states, to perceive, and take advantage of our culpable blindness, negligence, and mistakes.

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***

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CUTS.

PLATES.

LAWS

OF THE

PHILADELPHIA SOCIETY

FOR PROMOTING AGRICULTURE.

I.

THE society shall be stiled, THE PHILADELPHIA SOCIETY FOR PROMOTING AGRICULTURE.

II.

The society's attention shall be confined to agriculture and rural affairs,

III.

The society shall have a president, a vice-president, a treasurer, and a secretary; and an assistant-secretary, when the increase of business shall require it; all of whom shall be annually elected, by the tickets of a majority of the members present, at the stated meeting of the society in January; the persons, so elected, to continue in office one year, and until others shall be chosen in their stead. And in case of any vacancy, by death, resignation, or otherwise, the same may be supplied by a new election, to be made at any stated meeting of the society; the person thus newly elected, to serve the remainder of the year.

IV.

A quorum for business shall consist of at least five members, including the president or vice-president.

V.

At all meetings of the society the president shall exercise the usual duties of that office; all motions shall be addressed to him; and on all questions he shall collect and declare the votes. He shall also have power to call special meetings of the society, by notice published in at least two of the city newspapers. In his absence the same duties shall be performed by the vice-president. And if it happen, at any meeting of the society, that both the president and vice-president be absent, the members present (being a quorum to constitute a regular meeting for the business to be transacted) may choose a vice-president for that meeting.

VI.

The treasurer shall keep the accounts, methodically stated, in the books of the society; and, when called upon, produce them for inspection. At the last meeting of every year, and also whenever his office ends, he shall produce a fair and regularly stated account of all receipts, payments and expenditures; and deliver it, together with those books, and all other property of the society, in his hands, to his successor in office, or to the orders of the society.

VII.

The secretary and his assistant shall have in charge all the books and papers of the society, and keep the same in exact order. They shall also register all letters which shall be written by the committee of correspondence, or by themselves, by order of the committee.

VIII.

At the annual meeting of the society in January, shall be chosen a committee of correspondence, to consist of five members, any three of whom to be a quorum, for the pur-

pose of corresponding with any other society, or persons, touching the objects which this society has in view. The same members shall also be a committee of accounts, to receive and adjust all claims against the society, for its contingent expences; and the president shall give orders on the treasurer for the payment of them.

IX.

The stated meetings of the society shall be on the second Tuesday of every month.

X.

The members of the society shall be distinguished into *resident* and *honorary* members. The twenty-three persons named when the society was first proposed to be instituted, and whose names are entered in the minutes of the eleventh of February, one thousand seven hundred and eighty-five, are *resident* members, according to the eighth article of the first laws of the society, enacted on the fifteenth of March, one thousand seven hundred and eighty-five. All resident members, afterwards added to the society, were, and shall continue to be, of persons residing within a convenient distance to attend the meetings of the society at Philadelphia; and these are defined to be such only as, at the time of election, reside within ten miles of the said city, on either side of the Delaware. All members of agricultural societies in other states and countries, with whom we shall correspond, and all persons of this state, and of other states and countries, who shall be elected by us for the purpose, shall be *honorary* members; and are hereby invited to assist at our meetings, whenever they come to Philadelphia. Strangers who desire to be present, as auditors, may be introduced by a resident member.

XI.

New members, whether *resident* or *honorary*, shall be elected by ballot. And the secretary shall issue notice to each

person, of his being elected, to the following purport—*On the day of 17 A. B. of was elected a member* [or honorary member] *of the Philadelphia Society for promoting Agriculture; the society inviting his assistance.* *C. D. Secretary.*

XII.

All elections and appointments shall be between eight and nine o'clock in the evening, at one of the stated meetings of the society. And no person shall be elected a member, whether resident or honorary, unless, at a preceding stated meeting, he shall have been openly proposed, and such nomination duly entered on the minutes of the society. The nomination and election to be in the absence of the candidate.

XIII.

The society shall annually propose prizes upon interesting subjects, relative to actual experiments and improvements, and for the best pieces written on proposed subjects. And in order more effectually to disseminate the knowledge of useful discoveries and improvements in husbandry, the society will, from time to time, publish collections of memoirs and observations, selected from such communications as shall be made to them. To promote these views, the friends of agriculture are invited to assist the society with information of experiments and incidents in husbandry.

XIV.

All claims of prizes shall be sent in writing; and when read, the society shall determine which of the claims, relative to each prize, shall be selected for their definitive judgment, on a future comparison. This judgment is to be given at the stated meeting on the second Tuesday in February. If it happen, in any case, that there be no competition for a prize, but only a single claim, the society will consider such claim; and if the claim or claims be supported

answerably to the views and just expectations of the society, the prize proposed shall be decreed. Premiums and prizes are equally due to persons residing in any of the United States, according to the merit of their respective exhibitions.

XV.

For the purpose of defraying the necessary expences of the society, for premiums and prizes, books on agriculture, improved instruments of husbandry, and other important objects and contingencies, every member shall annually pay to the treasurer a contribution of TWO DOLLARS. This contribution shall be considered as due and payable at or before the last day of December in every year. And at the first meeting in January of every year, the treasurer shall lay before the society a list of the members, specifying who have, and who have not paid their contributions; and any member, whose contribution shall be found to be more than one year in arrears, after the same shall have become due and payable, as aforesaid, provided payment thereof has been personally demanded of him by the treasurer, or collector, authorised by him for the purpose, such member shall be considered as withdrawing from the society, and be no longer deemed a member of it; and the same shall be entered on the minutes.

XVI.

New rules, or alterations to be made in old rules, shall be proposed, and the proposal entered on the minutes, at a preceding stated meeting; and may then be made by not less than two thirds of the members present.

XVII.

When any part of the society's funds is to be disposed of, (excepting for ordinary contingent expences) the same shall be done at a stated or special meeting, after having been proposed at a previous stated meeting.

XVIII.

Still further to advance the objects of this institution, the society will promote the establishment of other similar societies in the United States.

XIX.

On the first meeting of the society in January, in every year, there shall be a revision of the then subsisting rules; and the same shall stand confirmed, so far as two thirds of the members present, including the president or vice-president, do not revoke or alter them.

A LIST

OF THE

MEMBERS

OF THE

PHILADELPHIA SOCIETY

FOR PROMOTING AGRICULTURE.

Note—Those members whose places of residence are not specified, are of Pennsylvania; and those marked * are honorary members.

OFFICERS OF THE SOCIETY FOR 1808.

PRESIDENT—RICHARD PETERS.
VICE-PRESIDENT—GEORGE CLYMER.
TREASURER—SAMUEL HODGDON.
SECRETARY—JAMES MEASE, M. D.

George Clymer.
Peter Aston.
Edward Burd.
*Elias Boudinot, N. Jersey.
Charles Biddle.
Henry Drinker.
John Dunlap.
Levi Hollingsworth.
Samuel Hodgdon.
Adam Kuhn, M. D.
Wm. Lewis.
John F. Mifflin.
John Nixon.
Rev. Joseph Pilmore.
William Rush, grazier.
*Wm. Embleton, Maryland.

John Vaughan.
Hugh Brackenridge.
*Lambert Cadwalader.
Joseph Cooper, N. Jersey.
Tench Coxe.
*John Curwen.
*Charles Thompson.
*James Tilton, M.D. Delaware.
*Dr. Aaron Dexter, Mass.
Miers Fisher.
*Wm. Fitzhugh, Virginia.
Wm. Hamilton, Woodlands.
John Lardner.
Jacob Barge,
Richard Bache.
*Thomas Bee, S. Carolina.
David H. Conyngham.
*George Clinton, N. York.
*Daniel Carroll, Maryland.
*Edward Carrington, Virg.
*Count Castiglioni, Milan.
Rev. Dr. White.
Caspar Wistar, M. D.
*Henry Wynkoop.
*Jonathan Williams.
Samuel Wheeler.
*Noah Webster, Connecticut.
*Arthur Young, England.
*Philemon Dickenson, N. J.
John Dickenson, Delaware.
Mr. Howard, Maryland.
Francis Johnston.
*John Jay, New-York.
George Logan, M. D.
*Geo. Morgan.
Gen. W. M'Pherson.
Timothy Pickering,
David Sellers.
Nathan Sellers.
George Fox.
Thomas Fitzimons.
Dr. Benjamin Say.

Members elected since April, 1805.

J. M'Intire, Delaware.
*George B. Lownes.
* General Wilkins.
*Gen. Geo. Wallace.
*Col. Cultbertson. Forks of Ohio.
*Philip Price.
Thomas Butler.
Thomas Cumpston.
John Dorsey.
Francis Gurney,
*Wm. West.
*Peter M'Call.
*Wm. Young.
*James Johnston. Ohio.
*Dr. J. M'Dowell. ditto.
*Derick Peterson.
*Henry Clymer.
Thomas Lieper.
John Leamy.
John Miller, M. C.
Israel W. Morris.

George Honey.
Thomas C. James, M. D.
Arch. M'Call.
James Mease, M. D.
Robert Poalk.
*Dr. Robert Rose.
David Sickle.
Edward Tilghman.
Charles Breck.
Thomas W. Francis.
Wm. Guier.
Dr. George Gallespie.
*Caleb Lownes.
*Luke W. Morris.
Wm. Poyntell.
Lawrence Sickle.
William Tilghman.
Robert Waln.
Zaccheus Collins.
Stephen Girard.
Godfrey Haga.
Anthony Fothergill, M. D.
*Moses Marshall.
*David Humphreys, Con.
*Thomas Porter.
Jacob Shoemaker.
Joshua Humphries, junr.
Wm. Montgomery.
John Thompson.
W. Coxe, Burlington, N. J.
Jeremiah Parker.
*Col. Lewis Morris, S. Caro.
*John Kaihn, N. Jersey.
*Wm. Fitzhugh, Maryland.
*Daniel Cowgill, Delaware.
Wm. Rawle.
*John Shallcross, Delaware.
George Sheaf.
Richard Wistar.
Frederick Heisz.
*Job Roberts.
John Clifford.
Paul Beck.
Joseph Cloud.
Thomas Harper.
Joseph Kirkbride.
Zachariah Poulson.
Richard Peters, junr.
Edward Pennington.
Jacob Sperry.
James Caldwell.
Anthony Morris.
Martin Dubs.
Gavin Hamilton.
*Ebenezer Zane, Virginia.
*Bazaliol Wells.
*Wm. Bakewell.
*Geo. Izard.
*G. W. P. Custis, Virginia.
Paul Busti.
*Samuel Dickey.
*John Garnett.
N. Brunswick, N. Jersey.
J. A. Eckfeldt.
*James Kelton.
*Albanus Logan.
Samuel Gibson.
*Nathaniel Comegys, Md.
*Thomas Main.
George-Town, Potowmac.

Samuel Meeker.
*John Taylor.
Port-Royal, Virginia.
*Joseph Priestley.
*Winthrop Sargeant, Natches
*Wm. Dunbar. ditto.
John Lang.
*Samuel Bayard.
Princeton, New-Jersey.
*Joseph Capner.
Flemington, N. Jersey.
*Caleb Kirk, Delaware.
*Detmar Bassa Muller.
*Paul Cooper, N. Jersey.
*Thomas Newbold, ditto.

OUTLINES OF A PLAN,

FOR ESTABLISHING

A STATE SOCIETY

OF AGRICULTURE

IN PENNSYLVANIA.

At a special meeting of the Philadelphia society for promoting agriculture, on the 21st of January, 1794.

AGREED, That Mr. Bordley, Mr. G. Clymer, Mr. Peters and Mr. Pickering, be a committee to prepare outlines of a plan for establishing a state society for the promotion of agriculture; connecting with it the education of youth in the knowledge of that most important art, while they are acquiring other useful knowledge suitable for the agricultural citizens of the state.

And a petition to the legislature, with a view to obtain an act of incorporation.

At a special meeting of the society, January 28, 1794.

The committee appointed at the last meeting to prepare outlines of a plan for establishing a state society for the promotion of agriculture, and a petition to the legislature for an act of incorporation, made report. The report was adopted. The same committee are now requested to sign the petition, present it to the legislature, and attend the committee thereof which may be appointed to confer with them on the subject.

To the Senate and House of Representatives of the Commonwealth of Pennsylvania.

The Philadelphia society for promoting agriculture, beg leave to represent:

THAT finding the important object of their association not to be sufficiently attained on the limited plan, and by the means hitherto pursued, they are desirous of promoting an establishment on a broad and permanent basis, which may afford more certain prospects of advancing the interests of agriculture. They also conceive that the acquiring a knowledge of it may be combined with the education which is practicable and most useful for the great body of citizens.

To shew what in their opinion may, *in process of time* be accomplished, they take the liberty of presenting to the view of the legislature, the annexed outlines of a plan for establishing a *State Society of Agriculture in Pennsylvania*, which shall embrace the aforementioned objects.

They pray that a committee of the legislature may be appointed to confer with a committee of the society on the subject; and, as the necessary means of conducting the execution of the plan, that an act of incorporation may be granted to the persons whose names shall be presented for that purpose.

By order and in behalf of the society.

JOHN B. BORDLEY,
GEORGE CLYMER,
TIMOTHY PICKERING,
RICHARD PETERS.

OUTLINES OF A PLAN, *&c.*

1. THE legislature to be applied to for an act of incorporation of the society, which is to consist of citizens of the state, as generally dispersed throughout the same as possible. In the first instance, the society to be composed of such persons as may be named, and these to be vested with authority to make rules for admission of other members, and by-laws for the government of the society, as usual in similar cases. Honorary members to be admitted according to rules to be established, and these may be of any state or country.

2. The organization of the society shall be so formed, that the business thereof may be done by a few, who will be responsible to the body of the society, in such manner as their by-laws shall direct.

3. The governor of the state, the speakers of the houses of the legislature, and the chief justice for the time being, to be the visitors of the corporation. The transactions of the active members, i. e. those entrusted with the monies and affairs of the society, by whatever name or description they may be designated, and all by-laws and regulations, to be submitted to the visitors ; to the end that the same may be so conducted and established as not to prejudice the interests of the corporation, or interfere with or oppose the constitution or laws of the state. The visitors will also judge of the objects of the society, and perceive whether or not they are calculated to promote the ends of its institution. Reports may by them be made annually to the legislature.—These will be useful, as they will exhibit in a comprehensive view, the state of agriculture throughout the commonwealth, and give an opportunity to the legislature of being informed on a subject so important to the prosperity of the

country, both as it relates to political œconomy and the individual happiness of the people. The legislature will perceive, from their reports, when and in what manner they may lend their assistance to forward this primary object: Whether by endowing professorships, to be annexed to the university of Pennsylvania and the college of Carlisle, and other seminaries of learning, for the purpose of teaching the chemical, philosophical and elementary parts of the theory of agriculture: or by adding to the funds of the society, increase their ability to propagate a knowledge of the subject, and stimulate, by premiums and other incentives, the exertions of the agricultural citizens: or whether by a combination of these means, the welfare of the state may be more effectually promoted.

4. Though it will be most convenient to make the repository of the information of the society, and the office or place of transacting its business at Philadelphia; yet it is intended that the society shall be rendered active in every part of the state. To effect this, there should be county societies established, organized as each shall think proper. In union with, or as parts thereof, there may be agricultural meetings or establishments, at the will of those who compose them, in one or more townships of a county. These may correspond with the county societies, and the latter may annually inform the society of the state (of which the less societies may be considered as branches) of all the material transactions of their respective societies. Societies already formed may remain as they are. They may, at their option, correspond directly with the state society, or through the society of the county in which they meet, as shall be found most convenient and agreeable to them. They will thus collect all the information and business relating to the subject, and will give an opportunity to the society of the state, to see where their assistance is most necessary, and afford a facility of diffusing agricultural knowledge. The premiums,

books and other articles, at the disposal of the society, may pass through the hands of the county or other societies, for many purposes; and they can judge on the spot, of the pretensions of the claimants. The county schoolmasters may be secretaries of the county societies; and the school houses the places of meeting and the repositories of their transactions, models, &c. The legislature may enjoin on these schoolmasters, the combination of the subject of agriculture with the other parts of education. This may be easily effected, by introducing, as school books, those on this subject; and thereby making it familiar to their pupils. These will be gaining a knowledge of the business they are destined to follow, while they are taught the elementary parts of their education. Books thus profitable to them in the common affairs of life, may be substituted for some of those now used; and they can easily be obtained. Selections from the best writers on husbandry may be made by the society. The essays of our own experimentalists or theorists, and the proceedings of the society, will also afford information; and as many of these will, no doubt, be good models of composition, they may form a part of the selection for the use of the county schools. And thus the youth in our country will effectually, and at a cheap rate, be grounded in the knowledge of this important subject. They will be easily inspired with a thirst for enquiry and experiment, and either never acquire, or soon banish attachments to bad systems, originating in the ignorance and bigotry of their forefathers, which in all countries have been the bane of good husbandry. It will also be the business of the society to recommend the collection of useful books on agriculture and rural affairs in every county. The citizens of the country should be drawn into a spirit of enquiry by the establishment of small, but well chosen libraries, on various subjects. This would not only promote the interests of agriculture, but it would diffuse knowledge among

the people and assist good government, which is never in danger while a free people are well informed.

5. The general meetings of this society, consisting of such members as may choose to attend, and particularly those charged with communications or information from the county and other societies, should be held at Philadelphia, at a time, in the winter sessions of the legislature, when citizens who may be members thereof, or have other business, can with most convenience attend. At these meetings, the general business of the society can be arranged, its funds and transactions examined, and its laws and rules reported, discussed and rendered generally serviceable and agreeable to the whole.

6. It will be necessary that a contribution be made by each member, annually, for a fund. But this should be small, that it may not be too heavy a tax. The funds will, no doubt, be increased by donations from individuals; and if the state should find the institution as useful as it is contemplated to be, the patriotism of the members of the government will be exercised, by affording assistance out of the monies of the state. They will perceive that it is vain to give facility to transportation, unless the products of the country are increased by good husbandry: And though these facilities are important to the objects of this society, yet an increased knowledge of agriculture is the foundation of their extensive utility. The subjects of both are intimately connected, and mutually depend on each other.

7. When the funds of the society increase sufficiently to embrace the object, it will perfect all its efforts by establishing *Pattern Farms*, in different and convenient parts of the state. Let the beginning of this plan be with one establishment, under the direction of the society, and committed to the care of a complete farmer and gardener. In this, all foreign and domestic trees, shrubs, plants, seeds or grains may be cultivated, and if approved as useful, disseminated, with directions for their culture, through the state. The most ap-

proved implements may be used on this farm, and either improved by additions, or simplefied to advantage. Inventions may be brought to trial, and the best selected. Models thereof may be made and transmitted to the county and other societies. Those who are sent to, or occasionally visit the farm, will gain more knowledge, in all its operations, from a short inspection, than can be acquired, in a long time, by reading on the use and construction of instruments, or the modes of cultivation. The cheapest, best and most commodious style of rural architecture—the most proper and permanent live-fences—improvements in the breed of horses, cattle and sheep—remedies for occasional and unforeseen visitations of vermin—the times and seasons for sowing particular crops—the adapting foreign products to our climate—and preventives against all the evils attendant on our local situation, or arising from accidental causes—may here be practically introduced. The thoughts and suggestions of ingenious men may here be put in practice; and being brought to the test of experiment, their utility may be proved, or their fallacy detected. This farm need not be large. On it the best systems now known may be carried through, and farther experiments made: promising youths may be sent from different parts of the state, to learn practically the arts of husbandry. Manures and the best mode of collecting them, may be tried; native manures should be sought after, and premiums given for their discovery. Their efficacy may be proved by small experiments on this farm, which should, in epitome, embrace the whole circle of practical husbandry. Similar farms may be added, as the funds increase; and thus practical agricultural schools be instituted throughout the state.

8. When the pecuniary affairs of the society become adequate, it will highly contribute to the interest of agriculture, if, at the expence of the society, some ingenious person or persons were sent to Europe, for the purposes of agricultural enquiries. It would be well too, if a few young persons,

of promising abilities, were sent thither, to be instructed in the arts of husbandry, the breeding of cattle, &c. and to gain a practical knowledge on all subjects connected with this interesting, delightful and important business, on which the existence, wealth and permanent prosperity of our country so materially depend.

9. Although it would seem that a great portion of this plan has reference to the older settlements of the state, yet in fact, many of its most useful arrangements will apply to new settlements, in an eminent degree. These settlements are, for the most part, first established by people little acquainted with a good style of husbandry. The earth, in its prime, throws up abundant vegetation, and for a short period rewards the most careless husbandman. Fertility is antecedent to his efforts; and he has it not to re-create by artificial means. But he is ignorant of the most beneficial modes whereby he can take advantage of this youthful vigour, with which his soil is blessed. He wastes its strength, and suffers its riches to flee away. A bad style of cropping, increases the tendency of fresh lands to throw up weeds, and other noxious herbage; and that luxuriance, which with care and system might be perpetuated, is indulged in its own destruction. It is discovered, when it is too late, that what was the foundation of the support and wealth of the improvident possessor, has been, by his ignorance and neglect, like the patrimony of a spendthrift, permitted, and even stimulated, rapidly to pass from him in wild extravagance.

The products of nature, in our new countries, seldom have been turned to account. The timber is deemed an incumbrance, and at present is perhaps too much so. The labour and expence of preparing for tillage are enormous; and, when the sole object is that of cultivation, very discouraging.* European books give us no lessons in these operations.

*At the present time (1808) the expence of clearing land is much lessened, owing to the great influx of population in our new countries; for five dollars per acre, land may be completely cleared of timber.

But when the experience of our people is aided and brought to a point, by an union of facts and the ingenuity of intelligent men, now too much dispersed to be drawn into system, it is to be expected, with the surest prospects of success, that our difficulties on this head will be abated, if not overcome. The manufacture of potash, and the products of the sugar-maple, may be objects of the attention of the society. More profitable modes of applying labour will hereby be promoted, and returns for expence, in the preparation for culture, be obtained. Facilities for clearing lands may be discovered. Minerals, earths and fossils now either unknown or neglected, may be brought into use, or become objects of commerce. In fine, no adequate calculation can be formed of the effects which may be produced by a consolidation of the efforts, and even speculations, of our citizens, whose interests will stimulate them to exertion. Channels of communication will be established, and the whole will receive the benefits arising from a collection of the thoughts and labours of individuals, whose minds will be turned to a subject so engaging and profitable, as well to themselves as to their country.

It is much to be regretted, that the excellent plan proposed in the foregoing outline, was not acted upon and carried into effect by the legislature to which it was presented. At some future period, it is to be hoped, that the importance of the measure will be duly estimated, and properly encouraged by our state government. Those who consider the effect of witnessing good practices, must be convinced, that no measure within the reach of man, would tend so completely to improve the agriculture of the state as a pattern farm. A similar establishment, though upon the plan of subscription was proposed by Sir John Sinclair, in London, in the year 1800, but was not carried into effect. A national farm was established by the French government in

1783, at Charenton near Paris, and afterwards removed to Rambouillet, and placed under the care of the celebrated Daubenton, and is continued to this day; a full proof that great benefit has been derived from it. At this place, the breeds of various kinds of good cattle are kept pure, particularly of fine woolled sheep, whence farmers from every part of the kingdom are supplied upon moderate terms, a regulation, from which it is evident the greatest advantages must be derived to the community at large.

"A Veterinary School is connected with the farm, and four other professorships established, two for rural œconomy, one for anatomy, and another for chymistry. There is a spacious apartment for dissecting animals, a large cabinet, where the most interesting parts of all domestic animals are preserved, and also of such parts of their bodies, that mark the effect of visible distempers. This, with a similar one near Lyons, is kept up, at the moderate expence of 60,000 livres, (2600 pounds sterling).

There are at present, about one hundred pupils from different parts of the kingdom, as well as from every country in Europe, except England; a strange exception, considering how grossly ignorant our farriers are."—*Travels by A. Young in France, in* 1787-8-9, *page* 67. *Lond.* 1792.

The following premiums were offered by the society in the year 1791, a short time previously to the suspension of their regular meetings. A part of them had been previously offered at different periods. They are now published with a view of calling the attention of farmers to the various important subjects noticed in them, and though the society do not deem themselves bound by the prizes offered in the list, in consequence of the subjects which have been proposed in that immediately following, yet they will always be happy in an opportunity of distinguishing, by some honorable mark, the enterprizing cultivator, who successfully attempts to improve the agriculture of his country.

PREMIUMS

PROPOSED BY THE

PHILADELPHIA SOCIETY

FOR PROMOTING AGRICULTURE IN THE YEAR 1791.

I. THE ROTATION OF CROPS having been found in England constantly to improve the soil instead of exhausting it—and the society being persuaded, that to this management alone is to be attributed the great comparative products of that country—they esteem it of the first importance to America to gain a knowledge of the theory and practice of so admirable a system.—Within the limits of this article, it is impossible to state, with any useful degree of precision, principles, which, after all, must vary with circumstances—but knowing that some farmers, in Pennsylvania and elsewhere, have already made themselves acquainted with this mode of husbandry; and that it is as much the interest, as it is within the power of all to obtain the necessary knowledge—the society without attempting to lay down any particular directions, offer—For the best experiment of a five years course of crops—a piece of plate, of the value of two hundred dollars, inscribed with the name and the occasion; and for the experiment made of a like course of crops, next in merit—a piece of plate, likewise inscribed, of the value of one hundred dollars.

II. The importance of complete farm or fold-yards, for sheltering and folding cattle—and of the best method of con-

ducting the same, so as to procure the greatest quantities of compost, or mixed dung and manure, from within the farm, induces the society to give for the best design of such a yard, and method of managing it, practicable by common farmers—a gold medal: and for the second best—a silver medal.

III. For the best method of raising hogs, from the pig, in pens or sties, from experience; their sometimes running in a lot or field not totally excluded, if preferred—a gold medal; and for the second best—a silver medal.

IV. For the best method of recovering worn out fields to a more hearty state, within the power of common farmers, without dear or far-fetched manures; but by judicious culture, and the application of materials common to the generality of farms; founded in experience—a gold medal; and for the second best—a silver medal.

V. For the best information, the result of actual experience, for preventing damage to crops by insects; especially the Hessian-fly, the wheat-fly, or fly-weevil, the pea-bug, and the corn chinch-bug or fly—a gold medal; a silver medal for the second best.

VI. For the best comparative experiments on the culture of wheat, by sowing it in the common broad-cast way, by drilling it, and by setting the grain, with a machine, equi-distant; the quantities of seed and produce proportioned to the ground, being noticed—a gold medal; for the second best—a silver medal.

VII. For an account of a vegetable food that may be easily procured and preserved, and that best increases milk in cows and ewes, in March and April, founded on experiment—a gold medal; for the second best—a silver medal.

VIII. For the greatest quantity of ground, not less than one acre, well fenced, producing locust trees, growing in 1791, from seed sown after April 5th, 1785; the trees to be of the sort used for posts and trunnels, and not fewer than 1500 per acre—a gold medal; for the second—a silver medal.

IX. The society believing that very important advantages would be derived from the general use of oxen, instead of horses, in husbandry and other services; and being desirous of facilitating their introduction into all these states; persuaded also, that the comparative value of oxen and cows must very much depend on the qualities of their sires and dams; and that by a careful attention to the subject, an improved breed may be obtained; they propose a gold medal for the best essay, the result of experience, on the breeding, feeding, and management of cattle, for the purpose of rendering them most profitable for the dairy, and for beef, and most docile and useful for the draught; and for the next best—a silver medal.

N. B. Among other things the essay should notice the different breeds of cattle, and their comparative qualities; as their sizes, strength, facility in fattening, quantity of milk, &c.

X. It is a generally received opinion, that horses in a team travel much faster than oxen; yet some European writers on husbandry mention many instances, in which it appeared, not only that oxen would plough as much ground as an equal number of horses, but also travel as fast with a loaded carriage: particularly when, instead of yokes and bows, they were geared in horse-harness, with such variations as were necessary to adapt it to their different shape. To ascertain the powers of oxen in these particulars, and the expence of maintaining them, the society deem matters of very great moment; and are therefore induced to offer a gold medal for the best set of experiments, undertaken with that view; and for the next best, a silver medal. In relating these experiments, it will be proper to describe the age and size of the oxen, their plight, the kinds and quantities of their food, the occasions, manner, and expence of shoeing them; in travelling, the kinds of carriages used, and weight of their loads, and seasons of the year, and the length and quality of the roads: and, in ploughing, the size and fash-

ion of the plough, the quality of the soil, the depth of the furrows, and the quantities ploughed: and, in every operation, the time expended, and number and sorts of hands employed in performing it; with any other circumstances which may more fully elucidate the subject. These experiments will enable the essayist to determine what will be the best form and construction of yokes and bows, and what of ox-harness, to enable oxen, with the best carriage of their bodies and heads, the most ease, and quickest step, to draw the heaviest loads, a description of each of which sort of gears, explained on mechanical principles, must be subjoined to the account of experiments.*

XI. For the best method, within the power of common farmers, of recovering old gullied fields to an hearty state, and such uniformity, or evenness of surface, as will again render them fit for tillage; or where the gullies are so deep and numerous as to render such recovery impracticable, for the best method of improving them, by planting trees, or otherwise, so as to yield the improver a reasonable profit for his expences therein, founded on experiment—a gold medal; and for the next best—a silver medal.

XII. For the best cheese, not less than five hundred pounds weight, made on one farm within the United States, and which shall be produced to the society by the first day of January, 1792—a gold medal†—and for the next greatest quantity, not less than two hundred and fifty pounds weight, of equal quality—a silver medal.

XIII. The society believing that the culture of hemp on some of the low rich lands in the neighbourhood of this city,

*The facts lately brought forward by Lord Somerville of England, are decisive as to the great œconomy of oxen for farm work: the experience too of the farmers in New-England shews, that the expensive animal the horse, is by no means so necessary as many suppose for agricultural labour. 1808.

†This premium was obtained by Mr. Mathewson of Rhode-Island.

may be attempted with advantage, do hereby offer a gold medal for the greatest quantity of hemp raised within ten miles of the city of Philadelphia. The quantity not to be less than three ton; for the second greatest quantity—a silver medal.

*** It will be left to the choice of those successful candidates for prizes, who may be entitled to the plate or gold medals, to receive the same either in plate or medals, or the equivalent in money.

The claim of every candidate for a premium is to be accompanied with, and supported by, certificates of respectable persons of competent knowledge of the subject. And it is required, that the matters, for which premiums are offered, be delivered in without names, or any intimation to whom they belong; that each particular thing be marked in what manner the claimant thinks fit; such claimant sending with it a paper sealed up, having on the outside a corresponding mark, and on the inside the claimant's name and address.

Respecting experiments on the products of land, the circumstance of the previous and subsequent state of the ground, particular culture given, general state of the weather, &c. will be proper to be in the account exhibited. Indeed in all experiments and reports of facts, it will be well to particularize the circumstances attending them. It is recommended that reasoning be not mixed with the facts; after stating the latter, the former may be added, and will be acceptable.

Although the society reserve to themselves the power of giving, in every case, either one or the other of the prizes, (or premiums) as the performance shall be adjudged to deserve, or of withholding both, if there be no merit, yet the candidates may be assured, that the society will always judge liberally of their several claims.

PREMIUMS

PROPOSED BY

THE AGRICULTURAL SOCIETY

OF

PHILADELPHIA

FOR THE YEAR 1806.

To be continued till any measure, experiment, or practice, now proposed, and commenced in this or the succeeding year, be brought to sufficient perfection and proof.

1. *Ascertaining the component parts of arable land.*

To the person who shall produce the most satisfactory set of experiments, to ascertain the due proportion of the several component parts of arable land, in one or more of the old counties of this state, by an accurate analysis thereof. A like analysis in detail must also be made of the poorest, medium, and richest soils, in the same county or counties. By a due admixture of these soils, or substances within the reach of common farmers, they are by these experiments, to be enabled to improve, by good tillage, and a course of applicable crops, the poorest or most worn land, with the materials found on their own farms, or those of their neighbours respectively.—Lime, or lime stone, is excluded, its qualities and effects be-

ing already well known. But clays, marles, gypsum and sand, or other natural substances, fall within the meaning of this proposal. The crops, so far as consistent with good husbandry, to be the same after improvement as before, and their relative product to be given. All auxiliary, and influencing circumstances to be mentioned; as well as the mode and results of the analysis; and the proportions of the combinations. Artificial manures, after improvement, (lime at this stage may be one) may be used, if the like had been before applied: and all the means and circumstances are to be fairly developed. A piece of plate of the value of one hundred dollars.

The object is, not only to promote experiments calculated to improve farms, out of the materials found upon them; and thus save, or extend the efficacy of artificial manures; but to excite a spirit of exploration for fossils, earths, marle, and clays, applicable to agricultural as well as manufacturing purposes. For subterraneous researches, the society have provided a very complete set of boring instruments, with which those who will use them effectually, may be accommodated.

2. *Trench Ploughing.*

For the greatest quantity and best trench ploughed worn land, not less than five acres. The trenching not less than ten inches deep.

The following mode of trenching is recommended, as being known to be practicable, and easily performed.

1. Provide a light plough, from 12 to 15 inches wide in the hind part of the span or sole, calculated to pare off the sod from 2 to 3 inches deep, according to the depths of the roots of weeds.

2. A strong heavy *Trench Plough*, capable of turning a depth of from 8 to 10 inches of mould, or earth. This must be one or two inches narrower than *the Paring Plough*, or it will cut into the unpared sod. The first is to be drawn by

a pair of horses or oxen. The second by two pair of oxen, or strength equivalent. A *Trench* must be first made, with the *Trench Plough* as deep as practicable. The *Paring Plough* must then pare the sod off the next intended furrow, and turn it into the trench. The *Trench Plough* follows, constantly, after the *Paring Plough*. This throws over a body of earth so as to bury all weeds, which are placed too deep for vegetation, and thus, by rotting, become manure. The mould board, of the Trench Plough, should have a thin plate of flexible iron (an old stone-saw the best) screwed on its upper edge, *vertically*, so as to extend the surface and accommodate itself to the curvature of the mould board.—With this auxiliary, the loose earth will be completely thrown into the trench. It is otherwise liable to run over, and choak the Plough. Both Ploughs (the latter the most) require bridles, or clevasses with notches and curvated regulators, to direct and fix both their depth and lateral course. Such are not uncommon. The east Jersey, or low Dutch plan, is the best for the Trench Plough. A Coulter is not much required.

This operation should be performed in the autumn, and the field lay through the winter, to attract from the air, whatever is the food of plants; and to receive the benefits of frequent frosts and thaws. The subsequent ploughing need be no deeper than usual in good tillage. If *limed* the first spring for *Indian Corn*, the better it will produce. A fallow crop *only* should succeed the trenching the first year; and *Corn* admits and requires frequent stirring and exposure of the soil. For the best experiment, *a gold*, and for the second best, *a silver* medal.

3. *A course on trench-ploughed ground.*

For the best and cleanest course of crops, on not less than five acres of land *trench-ploughed*. The course may be. 1. Indian corn. 2. Legumes. If beans or pease, of a species least subject to the bug; and sown on the fallow of the 2d

year, so as to be off in time for a winter crop of wheat or rye. Broad cast of the legumes as a cover, be preferable; though drilling will be highly useful. Potatoes may occupy a part, to be taken off in time for wheat. 3. Clover sown in the winter grain. 4. Clover. This course will be preferred in a competition, unless the society shall be convinced, by the results of another course, that in practice, turns out better. Manure admitted; but the best products, with the least artificial manure, will be preferred. A gold medal for the best; and one of silver, for the second best experiment.

The object of both the above premiums is, to introduce a practice, found very beneficial where it has been fairly tried; and to place the experiments in the hands of spirited and intelligent agriculturists, who will do complete justice to themselves, and the subject recommended to their exertions.

4. *Cover of Leguminous Crops.*

For the best and greatest crops of beans, pease, or other *legumes*, of the kind before mentioned, sown broad-cast, as covering on fallows, preparatory to winter grain. Not less than five acres, and left clean and fit for wheat. These crops ameliorate, and do not exhaust like all culmiferous plants and those whose seeds produce oil. *Oats*—the worst and most ruinous to succeeding winter crops.

The object is, to introduce the practice of valuable and improving covering crops, in preference to naked fallows, or exhausting covers. A silver medal, or fifty dollars.

5. *Destruction of perennial weeds.*

For the best set of experiments calculated for the destruction of *perennial weeds*. The *daisy* or *May weed*, *ransted*, *garlic*, and *St. John's wort*, to be particularly aimed at and noticed. A *botanical account* of the weeds commonly infesting our fields, will highly recommend these experiments; and communications, relative to all or any of those enumerated, will be gratefully received. This account should specially

mark the stages of their growth; and periods when they are the most easily destroyed, by the means employed. *Botanizing* for the destruction of weeds, is as necessary and laudable, as it is for the propagation and culture of useful plants.—Nothing promotes the health, increase, and value of the latter, more than expelling the former. *Trench ploughing* is excluded. This has been found to be the surest mode of destroying weeds; especially those with fibrous or bulbous roots. A gold medal.

6. *Dairy.*

To the person who shall exhibit to the society an account of the profits of the best *dairy*, applied to *butter* or *cheese*. Not less than twenty cows. The greatest proportion of cows kept the longest in profit, and the best. Winter feed (œconomy considered) for carrying the cows productively through the season, enters into the account. The greatest product from an equal number kept without change (except by substitution of well bred heifers raised on the farm) through the year, will have the preference. It is to be understood, that changing cows is not to be admitted, unless full proof, on the annual balance of account, that such practice is comparatively the most productive and profitable, when in competition with one predicated on keeping the same set of cows through the year. The same profits from the permanent dairy (unavoidable casualties allowed) will be preferred. It will be recommendatory of the pretensions of the claimant, if the account be accompanied with experiments, or practical knowledge of the best sizes, description, breed, and ages of dairy cows.

The object is, to induce an attention to the breed and selection of *dairy cows*. Their points and qualities differ from those proper for breeding beef cattle, or for venders of milk. Much depends even with the best stock, on regularity and attention in the dairy women. Unless great care in stripping, and regular periods of milking, are practised, as well as clean-

liness in keeping, the best cow will soon cease to be in profit. The quality, and not the quantity of milk is the most important. Nor are the largest the best for the dairy: especially where there are short bites and irregular seasons. A silver medal, or fifty dollars.

7. *Live Fences.*

For the best experiment on, or practical application of, any species of shrub or tree proper for live fences; and the most œconomical and practical mode of securing them in their early stages of growth, from injury by cattle or other enemies.

The general idea of European agriculturists has been confined on this subject, to *thorn* or *quick* inclosures. But these may not be found exclusively the best *here*. On *Long Island*, before the revolution, a very able and spirited proprietor of a large estate there, went very extensively into inclosures with quick set, procured not only in this country, but from Europe and elsewhere. He found the thorn, of every description, subject to many casualties and diseases; some of them unknown in Europe. Blights injured a great proportion, after they were in sufficient growth for inclosure without protection. It was not frequent that a sound crop of haws was produced; these being subject to the worm, and other impediments to their perfection. Although it is still desirable, that every attention should be paid to the *hawthorn*, it is not improbable that some other of our native shrubs or trees, may thrive as well, if not better; and equal the thorn in utility. The object therefore is, to promote enquiries and experiments that shall determine this point. The *walnut*, the *apple*, the *honey locust (Gleditsia triacanthos)* the *white flowering locust (Robinia pseudo-acacia,)* have been tried, on a small scale—Each has its peculiar disadvantages. The white mulberry has also been recommended.

Live fences are of such high importance, in our old settlements, where the timber is daily decreasing, and the expence of inclosure becoming so very serious, that the society cannot sufficiently express their wishes, that some spirited and extensive measures may, without loss of time, be commenced on this momentous subject. The present generation may receive incalculable advantages from successful experiment and practice, in a desideratum so eminently interesting to them. But posterity will bless the memory of those, of whose genius and labours they enjoy the fruits. They will gratefully feel the benefits of durable inclosures, commenced, if even not entirely perfected, in our day: and while they inherit these safe guards to their property, they will perceive the insurmountable difficulties to which they would have been exposed, by a neglect on our part, to establish and provide them.

A gold or silver medal—according to the merit and extent of the experiment or practice.

8. *Clearing and cropping new Lands.*

For the best essay, practical and theoretical, founded on experience and facts, as well as calculation and investigation, of the most approved and beneficial mode of clearing and cultivating new settlements, in an unseated, and theretofore uninhabited part of this state, or one in its neighbourhood. A gold medal.

The practice heretofore used of *girdling* trees, can only be justified by the necessity of doing it, through want of labourers, by those who first enter a wilderness. But if lands are inviting, population soon increases, and yet the practice of girdling the timber continues. One part is *girdled* after another, without foresight or precaution. Timber is wantonly, because lavishly and unnecessarily destroyed; and becomes in a few years scarce, where its abundance was at first accounted a burthen. *Culmiferous crops* [plants composed of *straw* and *chaffy husks* for the grain] follow one another in

uninterrupted succession, the worst of all bad husbandry.—These are "*stubbled in*" (the phrase of new settlers) till the land is exhausted, and produces nothing but *sorrel* and other execrable vegetation. The timber rots and falls, sometimes dangerously to men and cattle. It is burnt and destroyed, when the field, after a useless waste of time, is cropped again. Fencing, fuel, building, implements, &c. call for timber—but it is distant or gone. The field is choaked with briars, worthless shrubs, and other pests, and its cultivation is generally more expensive than if well cleared originally, and occupied by wholesome and productive crops, either of grain or grass.

Many of us are interested in new lands—and all of us, from public motives, wish to introduce a better stile of clearing and cropping into our new countries. Information from several new settlements (particularly some in the state of New-York) is favourable to a far better plan, of both clearing and cropping. It is, to till less ground cleared perfectly; and crop, according to circumstances, as near as practicably to the rules of good husbandry. Labourers are not there in greater plenty, than elsewhere, in such settlements; and yet the settlers succeed and thrive.

Our object is therefore, to obtain and promulgate every species of information; and thereby be enabled to recommend and encourage better modes of clearing, and a more advantageous, as well as reputable stile of husbandry, in our new countries.

There are in these countries, many intelligent citizens, who may, and it is hoped will assist in both example and investigation. But some of these have not correct ideas on this subject. They conceive that the art of husbandry, for the most part, consists in restoring, or creating fertility, which in new lands is the gift of nature. But the fact is, that fertility without good management, like a savage in power, and subject to no civilized regulation, as often exerts itself mischievously as profitably. It frequently ruins by de-

sultory and misapplied operations. Weeds and other worthless products, are its offspring. These, in many cases, might be prevented, destroyed or converted into benefits, with well directed systems. To instance only the *sorrel* apparently the most mischievous and forbidding. It has been found that with *lime*, it may be made a powerful and efficient auxiliary to profitable crops, and when judiciously applied is known in Europe to be so valuable, that the sorrel is propagated for its uses in husbandry. Limestone is found abundantly in most of our new lands, or at least, in very extensive districts. Careful experiments may point out the mode of liming lands overrun by this apparent pest, so as to destroy its bad qualities, and convert it to salutary and profitable purposes. If this be not now deemed eligible in parts where land is less valuable than *labour*, it will nevertheless be an object e'er long, when the products of land are unattainable, without combinations of labour with ingenuity, good management and appropriate systems of husbandry.

9. *Veterinary Essay and Plan.*

For the best *essay and plan* for promoting *veterinary* knowledge and instruction, both scientifically and practically, *under the circumstances of our country.* Aid to schools and establishments for this, among other agricultural purposes, ought to be given by the national and state legislatures. But *agriculture*, and the subjects connected with it, have not heretofore been cherished by their patronage. Her young sister, *commerce*, has fortunately fascinated with contributions to revenue, and thereby secured protection and encouragement. But private and individual exertions, for the accomplishment of agricultural objects, must, from necessity, be resorted to, for public benefits derived from this primary source of all the wealth and prosperity we enjoy.—Some of the most worthy and truly respectable governments, and many of the most eminent men, in Europe, have deemed

the object here recommended, honourable, politic, and promotive of the public interest and prosperity. While agriculturists are employed in the production of *plants*, their stocks of useful *animals* are abandoned, when diseased, to all the calamities attendant on ignorance of their maladies, or cure. Pretenders and empirics, of the most contemptible characters, prey on the necessities and credulity of those who are compelled to apply to them on this subject.

The essay proposed, should among other requisites, be calculated to rouse the attention of medical professors, to this important branch of neglected knowledge. It should convince them, that they cannot employ themselves, in any part of their studies, in a manner more conducive to *real* respectability of character, than in gaining and promulgating information, so intimately connected with the wealth and political œconomy of their country. This society pledge themselves to distinguish, with some testimony of their gratitude, any medical professor who will assist them in calling the attention of students, to this very interesting subject.

Investigations into *anatomy*, *diseases* and *remedies*, for the preservation and improvement of animals, on which our subsistence and comforts so materially depend, must assuredly be considered worthy the most patient enquiry, intelligent observation, and professional talents, of the most celebrated among those, who have devoted themselves to medical pursuits. As patriots, it should stimulate their public spirit.—As professional men, nothing can more entitle them to the rewards due to their labours. Who is there among the most respectable of our own citizens, or in the highest grades of society in the old world, who has not deemed it meritorious to promote the interests of agriculture? And is there any branch of that occupation so important, as that now recommended to the notice and enquiry of medical men? If it has held an inferior rank in the classification of science and knowledge, it is entirely owing to the unmerited neglect with

which it has been unaccountably treated. It is time it should be rescued from obscurity, and placed among the most commendable and necessary branches of medical education. A gold medal.

10. *Domestic or Household Manufactures.*

For the best and greatest quantity and quality of woolen, cotton or linen fabrics, made in any family, by the members thereof. Weaving, fulling, and dressing, may be done as usual, in the accustomed modes of performing these operations. The object is, to encourage industry in the families of farmers and others, at times when leisure from other occupations permits. Such intervals are too often filled up with dissipation, or suffered to pass away in indolent waste or inattention. The materials being raised or produced on the farm, will entitle to preference in a competition. The breed of sheep, and quality of wool, will be peculiarly recommendatory. A silver medal.

Although the society have principally confined their premiums to honorary distinctions, they will always be ready to commute them for, or add pecuniary reward *to assist* in expensive or difficult experiments. Our *funds* are far below our *zeal. But the former* are not of so much moment, as energies excited by emulation, among those who have strong propensities to benefit their country, while they are labouring for themselves. Without the co-operation of our fellow citizens of this description, all our well meant endeavours are vain!

*** For rules respecting claims—See the laws, art. 14.

RICHARD PETERS, *President.*

JAMES MEASE, M. D. *Secretary,*
No. 192 *Chesnut-street—to whom communications may be sent.*

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Transactions of the Horticultural Society of London.
Young's Agricultural Survey of Essex.
Dickson's Agricultural Magazine.
Scott's Plates of Prize Cattle.
Boydell's ditto.
White's Veterinary Medicine, 2 vols.
Forsyth on Fruit-trees.
Epitome of Forsyth. Presented by J. Humphreys.
Gleanings of Husbandry. do. do.

THE following very appropriate and interesting Lecture, was delivered by DR. RUSH, at the request of the President of the Philadelphia Agricultural Society, in compliance with motives impressed by the recommendations of that Society in their premiums. He has permitted it to be printed among their Memoirs, at the request of the members of that Society, who attended its delivery.

An Introductory Lecture to a Course of Lectures, upon the Institutes and Practice of Medicine, delivered in the University of Pennsylvania, on the 2nd of November, 1807; *upon the duty and advantages of studying the Diseases of Domestic Animals, and the Remedies proper to remove them. By* BENJAMIN RUSH, M. D.

GENTLEMEN,

THE science of medicine is related to every thing. A mere physician, that is, a physician who knows nothing but the sciences which are supposed to belong exclusively to his profession, is a non-entity. To deserve that title in its extensive import, it is necessary for us to know something of the principles and practice of every art, and pursuit of man. There is scarcely one of them that does not furnish some useful facts, or striking analogies, which may be applied to practical purposes, or to the support of some important principle in medicine. Even the science of morals is capable of affording aid to the healing art by its influence upon the understanding through the medium of the passions. It produces this effect

in proportion to the extent of the objects to which we direct our benevolence. The physician who loves the whole human race, will always be actuated with more zeal to extend the usefulness of his profession, than the physician whose affections are confined to the limited circle of his habitual patients. His zeal will be more active, and more impressive upon his understanding, should he descend in the overflowings of his benevolence from the human species, and embrace in his studies and labors the means of lessening the miseries of domestic animals. This part of the brute creation have large demands upon us. The design of this lecture is simply to point out the duty and advantages of studying their diseases, and the remedies that are proper to remove them.—The subject is an interesting one to private gentlemen as well as to physicians, and I entertain too high an opinion of the good sense and correct views of medical science of my present audience to believe, that a few remarks upon it will be deemed an improper introduction to a course of lectures upon the institutes and practice of medicine.

We are bound in the first place to discharge the important duty to domestic animals which I have mentioned, by the relation that has been established between them and us by the author of nature. They were created at the same time, and from a portion of the same dust of which our great ancestor was formed. They are the only part of the brute creation over which man has retained his dominion since his banishment from paradise. We are to them (says Dr. Hartley) the vicegerents of God; and empowered to receive homage from them; and we are obliged by the same tenure to be their guardians and benefactors.* Their subjection to death, and all the diseases and pains which they feel in common with us, are the effects of the same rebellion against the Go-

*Observations on the frame, duties and expectations of man. Vol. 1. p. 415.

vernor of the universe which subjected Adam and all his posterity to the same evils.

The diseases of the animals which still roam the forests, and refuse to be subject to man, are few in number, and generally of so mild a nature as to yield to the operations of nature. But this is far from being the case with domestic animals. Like the human race, they acquire new and violent diseases by civilization, or by the manner of life to which their connection with us, and their subserviency to our interests and pleasures expose them. Even parturition so perfectly the work of nature in beasts of prey, is often attended with the same difficulty and danger in domestic animals that take place in women. Of this Dr. Bland has mentioned some remarkable instances in his observations upon human and comparative parturition. Similar instances have been communicated to me by Dr. Dewees, as having occurred under his notice while he practised midwifery in the neighbourhood of Philadelphia.

2nd. We are bound to study the diseases of domestic animals, and the remedies that are proper to cure them, by a principle of gratitude. They live only for our benefit. They cost us nothing in wages or clothing. They require in exchange for their labor, and all the other advantages we derive from them, nothing from us but food and shelter, and these of the cheapest and coarsest kind, so that there is constantly due to them, an immense balance of debt from us. This motive to take care of their health and lives will appear more striking when we consider the specific benefits we receive from each of them. The horse is not only an important appendage, but a necessary part of the cement of civilized society. He ploughs our fields,—he drags home our harvests and fruits to our barns and cellars. He conveys them from distant countries, over rough and difficult roads, to our market towns and sea ports. He receives in exchange from them, the products of foreign nations, and conveys them to the in-

terior and remote parts of our country. He keeps up the inland connection between different states by means of stages and posts, and thus favours the quick communication of intelligence, and the increase of national intercourse, commerce and happiness. He administers to our health and to our pleasures under the saddle, and in harness. He keeps up society and friendship in neighbourhoods too scattered in its population to admit of visits upon foot. In vain would country churches and courts be opened, without the strength of this noble animal; nor could the great system of representative government be supported in an agricultural country unless he conveyed the elector to the place of suffrage. In maintaining the freedom and independence of nations, the horse bears a distinguished part. When caparisoned with the furniture of war, he feels with his rider, the courage and the pride of arms. In the race, he delights us with his swiftness, in which he exceeds all other four footed animals.—Nor let us forget his sagacity in discovering roads, and chusing the safest parts of them, when inattention or darkness, has rendered his rider, or driver unable to discover them.---In the physician's midnight excursion to visit the sick, how often has his horse conducted him in safety, (and sometimes overcome by sleep) through imperceptible paths, and across deep and rapid currents of water to the door of his patient, and again, back to his own home. Still further, how often has the convivialist who has sat too long over his evening bowl, owed his life or his limbs to the good temper of this faithful animal, who in spite of a contrary direction of his bridle, has carried him with unbroken bones to the arms of his servants, to be conveyed by them to his bed in order to dose away the remains of his intoxication.

To the horned cattle we are indebted for many of the blessings and comforts of life. The strength and patience of the ox in the plough and the team, have added to the wealth of the farmer in every age and country. The cow has still great-

er demands upon our gratitude, Her milk, in its simple state, furnishes subsistence to a great part of mankind. Its products in cream, butter and cheese, form the most agreeable parts of the aliment, and even of the luxuries of our tables. A pustule upon her udder supplies a matter which when introduced into the body defends it for ever from the small-pox, and without substituting in its room, a painful or loathsome vicarious disease. Millions in every part of the globe unite with us in expressions of gratitude to heaven for this important contribution to the happiness of the human race. But our obligations to this benefactor of mankind, and to her whole species, do not cease with their lives. Their flesh affords us the most agreeable aliment after death. Their tallow and the oil which is interposed between their joints, supply the absence of the sun in candles and lamps, whereby labor and study are profitably extended during a part of the night. Their hair affords a necessary ingredient in the plaister of our houses. Their skins protect our feet and legs in the form of shoes and boots from the injuries of the weather. They furnish likewise coverings for our books and pleasure carriages, and saddles for our horses. Their horns supply us with combs, and even their bones are converted when fresh into aliment, and when dry, into a salt of extensive use in medicine and in a variety of the arts.

Sheep occupy the next rank in the list of domestic animals in their claims upon our science. They afford us by their wool a covering from the inclemency of winter during every year of their lives, and by their deaths they supply us with a delicious aliment in the forms of lamb, and mutton.

The hog is said like the miser to do good only when he dies. But this is so far from being true that he is dishonored by the comparison. He fattens upon the offals of our kitchens, and performs the office of a scavenger in cleaning the streets of our cities from putrefying masses of animal and vegetable matters. At his death, he bequeaths us his

flesh for food, his hair for brushes, and his fat for medical and culinary purposes.

The immense and profitable disproportion between the labor of the ass and the mule, and the expense of their food, render their health of great importance in those countries where wheel carriages cannot be employed to convey the products of the earth to a public market.

The goat by its contributions of the delicate flesh of its young, and of its medicinal milk to our use, is entitled to a share of medical attention.

The courage and fidelity of the dog in defending our persons and property from the midnight assassin and robber, and the usefulness of the cat in destroying or chasing from our houses the mischievous animals that infest our cellars and closets, entitle each of them to an enquiry into the causes and cures of their diseases.

It remains only to mention the claims of poultry of all kinds, to a physician's care. They adorn our yards and fruit trees with their plumage. They inform us by their crowing, and other noises of the approach of day. A part of them furnish us with eggs for aliment, with quills for writing, and with feathers for our beds; and all of them, in a greater or less number at a time, generally constitute after death a portion of our banquets, where a display is intended of hospitality or elegance.

In addition to what has been said in favor of domestic animals in their individual capacities, I shall only remark that collectively, they lessen the solitude and silence of a country life. They please us with their gambols when young, and delight us, by their looks and gestures in mature life, every time they receive food or shelter from our hands. They furnish the means of encreasing and perpetuating the fertility of our lands, and finally they gratify us with a sense of our sovereignty over their labor and their lives; and thus furnish us with a small portion of that pleasure which the father of the

human race enjoyed, when he received from his Creator the commission of his extensive dominion over all the creatures that live and move upon our globe.

A third reason why we are bound to study the causes and cure of the diseases of domestic animals, is because nature is wholly *passive* in such of them as are violent, or does harm in her efforts to remove them. This is evident in a more especial manner in the epidemics which sometimes prevail among them. The horses, cattle and sheep, of large neighbourhoods, and extensive districts are often swept away by those general diseases where no aid is afforded from medicine.

4th. By studying the diseases of our domestic animals we may rescue them from the hands of quacks, who add to the mischievous and unsuccessful efforts of nature, the evils of absurd, painful, and destructive remedies. Under this head I shall introduce a passage from the words of Mr. Vial, which exhibits those evils in the most expressive and affecting language. Speaking of the veterinary science, he says, " At this moment all appears obscured or bewildered by the ill placed confidence of the owners of cattle upon the blacksmith of the parish, upon illiterate and conceited grooms, stupid and listless shepherds, or upon a set of men infinitely more dangerous than all the rest. Who arrogating to themselves the style of doctors, ride about from town to town, distributing their nostrums, compounded of the refuse and vapid scraps of druggist's shops to the destruction of thousands, whose varied disorders they treat alike, neither consulting nature, or art, for the cause or effect.

" Miserable animal! bereft of speech, thou can'st not complain, when to the disease, with which thou art afflicted, excruciating torments are superadded by the ignorant efforts of such men, who at first sight, and without any investigation to lead them to the source of thy disorder, pronounce a hackneyed common place opinion on thy case, and then proceed,

with all expedition to open thy veins, lacerate thy flesh, cauterize thy sinews, and drench thy stomach with drugs adverse in general to the cure they engage to perform."*

5th. It is our duty and interest to attend in a more especial manner to the health of those domestic animals which constitute a part of our aliment, in order to prevent our contracting diseases by eating them. Certain vegetables upon which they feed by accident, or from necessity, impart to the milk and flesh of some of them an unwholesome quality. Great labor sometimes has the same effect. A farmer in New-Hampshire, who had overworked a fat ox a few years ago in the time of harvest, killed him and sent his flesh to market. Of four and twenty persons who ate of it, fourteen died, and chiefly with diseases of the stomach and bowels. Putrid exhalations produce obstructions and ulcers in the livers of cattle, sheep and hogs which render them unfit for aliment. They are moreover always unhealthy during the season in which they propagate their species; hence the wisdom of that church which substitutes fish for flesh during a part of the spring months. Even the heats in summer, in middle climates, lessen the wholsome quality of flesh,—hence the propriety of living chiefly upon vegetables with a small portion of salted meat during the summer and autumnal seasons.

6th. We are further called upon to study the causes, seats, and remedies of the diseases of domestic animals, by the duties which we owe to our country and to humanity. The products of agriculture and commerce are often lessened by a fatal epidemic, brought on by diseases which blast the character of animal provisions; and many poor families have been left to suffer all the evils of penury and famine, by the death of a single horse, upon whose labor, of a cow, upon whose milk, or of a hog upon whose flesh, they had relied exclusively for

* General Observations on the Art of Veterinary Medicine, p. 16, 17.

subsistence, all of whom perhaps perished by diseases that might have been cured.

7th. By extending our knowledge of the causes and cure of the diseases of domestic animals, we may add greatly to the certainty and usefulness of the profession of medicine as far as it relates to the human species. The organization of their bodies, the principle of animal life, and the manner in which the remote and proximate causes of diseases produce their morbid effects, are the same as in the human body, and most of medicines produce in them, and us, nearly a similar operation. Their acute diseases are the same as ours. They are subject to epidemics from an impure atmosphere as well as from contagions. Fevers, catarrhs—hæmorrhages—dysentery—dropsy—scrophula—vertigo—madness—worms,—stone, hydrophobia and apoplexy, affect horses, horned cattle, sheep, hogs and dogs. The rheumatism, angina and tetanus affect horses. Cows are subject to diabetes. Cancers have been observed in dogs. Cats suffer and die from a disease which appears to be a form of bilious fever. Cutaneous eruptions and sores are common to them all. In short, when we except the diseases which are the effects of certain trades and professions, of intemperance, of the operations of the mind, and of a peculiar function in the female body, there is scarcely a form of disease mentioned in our systems of nosology, but what is to be met with in domestic animals.

To encourage us to extend to them the benefits of medicine, let us attend to the light and knowledge which several branches of our science have already derived from them. During those ages in which it was deemed criminal to dissect a human body, the bodies of domestic animals afforded the only sources of instruction in anatomy and physiology, and even since those ages of ignorance and prejudice have passed away, many important discoveries have been derived from the same sources by accident or design.

The discovery of the salivary glands in an ox by Dr. Wharton; of the fallopian tubes in an ewe by Rufus; of the thora-

cic duct in a horse by Eustachius; of the lacteals in a kid by Erasistratus, and of the pancreas in a turkey, by Dr. Maurice Hoffman, led to the discovery of the same parts in the human body; and it is well known that the circulation of the blood, and the peristaltic motion of the bowels in man, were first suggested by experiments and observations upon those functions in some of the above named animals.

Many useful hints have been taken from the instincts of domestic animals. They generally retire to places of silence and darkness, and discover an unwillingness to move, and to eat, when indisposed, and thereby teach us the advantages of retirement, rest and abstinence in the beginning of acute diseases.

The approach of epidemics is often known by the sickness of certain domestic animals, or by their deserting our habitations.

Many useful remedies for the cure of the diseases of the human body, have been discovered by observing their salutary effects upon domestic animals. The hellebore was introduced into practice as a purge, in consequence of its purging qualities having been observed in the goat. The use of the seton in certain diseases of the human body, was first suggested by its efficacy in the diseases of cattle. The benefits of frictions in glandular diseases, are pointed out by the improvement in the quality of the milk, and the increase of its quantity, which are obtained by currying the cow.

The benefits of fasting in fevers, are strongly urged by the slow putrefaction of the flesh of domestic animals, which are deprived of food several days before they are killed.

The benefits of wakefulness, and a standing posture in curing madness, are suggested by the practice of some of the farmers in England, who tame the most intractable and vicious horses, by confining them in a pound, and keeping them awake and upon their feet, by pricking them with a sharp nail, for three or four days, whenever they show a disposition to sleep or to lie down.

The cure of madness in a dog, by means of a profuse hæmorrhage which followed the cutting off his tail, suggests the propriety of copious blood-letting in the hydrophobia. Perhaps a remedy uniformly certain in that awful disease, may be reserved to reward the successful application of industry and humanity, to its cure, in the affectionate centinels of our houses and our lives.

The safety of blood-letting in old people, is deducible from the appearances of inflammation which are discovered in the bodies of old animals that die of acute diseases. The famous race horse Eclipse, so long known and celebrated at New-Market in England, died in the 26th year of his age of a colic, after two days sickness. Upon dissecting his body, not only the whole aliementary canal, omentum and mesentery, exhibited marks of violent inflammation, but the stomach, liver, spleen, lungs, blood vessels and glands, all discovered the same, and other effects of the highest degree of morbid excitement.* Many other instances of the light which the anatomy, physiology, and remedies for the diseases of domestic animals have shed upon medicine, shall be mentioned from this chair in our lectures upon the institutes and practice of physic.

8th. We are bound to study the means of preserving the health of domestic animals, by all those precepts in the Old and New Testament, which recommend kindness to them, and protection from outrage and oppression. A portion of the humane spirit of those precepts has pervaded all countries, and descended in a particular manner to the nations of the east. One of the tales of a philosopher of India, has recorded this fact in a striking manner. A traveller who was permitted to visit the place of torment for wicked men, saw there every part of the body of a man of high rank in flames, except one of his feet. Upon asking the reason why that part of his body alone was exempted from the rage of the fire, he

*Vial's elements of the Veterinary art, p. 9, 10, 11.

was told, that the only kind action that man had performed during his whole life, was to liberate a lamb which had been entangled by one of its feet, by means of a briar, in crossing a field, and that as a reward for that act, his foot was exempted from punishment.

I proceed in the ninth and last place, to mention a reason for making the health of domestic animals the subject of our studies and care, which I should hesitate in delivering, had it not been sanctioned by the name of a man whose discoveries in physiological, metaphysical, and theological science, mark an æra in the achievements of the human mind: I mean the great and good,—I had almost said the inspired Dr. Hartly——And that is, their probable relation to us in a resurrection after death, and an existence in a future state. I shall read a short passage from the Doctor's works upon this subject. After expressing a doubt concerning the redemption of the brute creation, he adds, "However, their fall with Adam, the covenant made with them after the deluge, their serving for sacrifices for the sins of men, and as types and emblems in the prophecies, and their being commanded to praise God, seem to intimate that there is mercy in store for them, more than we may expect, to be revealed in due time."*

In favor of these remarks of Dr. Hartly, it may be said, that as moral evil and death accompanied each other in the human race, they are probably connected in the brute creation—That they possess nearly all our vices and virtues; that the perfection of the divine government required that their vices should be punished and their virtues rewarded; that reparation should be made to them for their accumulated sufferings in this world; and that the divine bounty discovered in the gift of their pleasures would be rendered abortive, unless they were placed in a situation to make returns for them, in praise and gratitude in a future state of existence.

*History of Man. Vol. ii. p. 486.

It is alike foreign to my inclinations, and to the design of this lecture, to enter further into this question. To such of you as wish to see all the arguments that are urged in its favor, from reason and revelation, I beg leave to recommend the perusal of an essay in the works of Dr. Hildrop, a learned and pious clergyman of the church of England, intitled "Free thoughts upon the brute creation." In whatever way the controversy may be decided, I shall only add, that a belief in the opinion suggested by the physician, and defended by the divine, whose names have been mentioned, is calculated in no one instance to do any harm, but on the contrary, much good, by increasing our obligations to treat our domestic subjects with tenderness and care. If the opinion be erroneous, let the justice and mercy of the SUPREME BEING, in his conduct to his brute creation, remain unimpeached. The divine government in this world, may be compared to the dreary prospect of an extensive and highly cultivated country, on a winter's day. The last revolution of our globe, will clothe this prospect with all the beauties of the vernal, and all the products of the autumnal months. It will then appear that the apparent discord in the *being* and *end* of all intelligent and animated creatures, was

——————"Harmony not understood;"

And that all their sufferings were a necessary part of "universal good."

But if the claims of domestic animals be so numerous, and the advantages of attending to their health be so great, and above all, if their high destiny hereafter be in the least degree probable, it may be asked, why do we doom them with so much cruelty to premature death, and afterwards feed upon their flesh? I answer, that by destroying them we prevent their perishing by hunger, for in the present state of cultivation of our earth, there would not be subsistence for them and their offspring for more than a few years, by which means their species would soon be extinct. By thus multi-

plying their numbers, we multiply life, sensation, and enjoyment. We moreover prevent the pains of a gradual death from sickness, and the miseries of a helpless old age. To destroy them by the knife, therefore, and to use them as a part of our food, is so far from being cruel, that it is an act of kindness and benevolence to them.

To the proposal for studying the diseases of domestic animals, it may be objected that their want of speech will forever prevent their imparting to us an account of the seats and symptoms of their diseases. This objection, I am aware, will be urged by those physicians who believe that every disease has a specific proximate cause, and requires an appropriate remedy; but students of medicine, who believe that all diseases have *one* proximate cause, will find no difficulty in discovering their existence and force in dumb animals.—The full or frequent pulse, the loss of appetite, the dejected head, and the languid and watery eye, are certain marks in all brute animals of one of the most frequent diseases with which they are affected, that is fever. The watery eye, an inability to bark, or barking with a stertorous hoarsness, indicate the approach of madness in the dog. The elevation of the hair on the back of a cat, and its not falling upon its feet when thrown from a moderate hight, are the premonitory signs of that disease which has lately been so fatal to that species of animals in Europe and America. The tail of a horse losing its regularity of motion from side to side, indicates that he is indisposed, and the part in which his disease is seated is pointed out, by one of his ears inclining backwards to the side affected. In acute pains, particularly from the colic, he bites his manger. The seat of diseases in the abdomen where the signs are absent, may be known by pressing the hand upon the whole belly of the animal. It will discover marks of pain, when the diseased part is pressed. Diseases of the head, lungs, kidneys, limbs and skin, are as easily known as the same diseases are in the same parts of the human body.

There are indeed circumstances, which favour our acquiring a more accurate knowledge of the diseases of dumb animals than of those of our own species. From the causes formerly mentioned, the number of their diseases is more limited, and their symptoms are more obvious, for they are not multiplied, nor complicated by intemperance in eating or drinking, nor are they under the influence of passions which suspend or alter them, and in some instances, to prevent their evolutions.

The seats of their diseases, moreover, are more perfectly known from the greater facility of dissecting and examining their bodies after death. Again there are circumstances which favour the operation of medicine upon them, of which we are deprived in our fellow creatures. These are, no prejudices against the names or taste of medicine,—a rare rejection of them after they have been received into the stomach, and the absence of all fear and solicitude, about the issue of their diseases.

I have then, gentlemen, laid before you, a brief detail of the obligations we owe to our domestic animals, and the reciprocal advantages to be derived from extending to them the benefits of the science of medicine. In performing this task, I have endeavoured to become the organ of speech for the dumb, and a suppliant for creatures that are unable to plead for themselves.

Permit me to recommend the subject to your attention in your future studies. From the knowledge you will acquire of the anatomy of the human body in this university, of the laws which govern its œconomy, you will easily comprehend the small deviations from both, which take place in the bodies and functions of inferior animals. By acquiring this kind of knowledge, you will add to the resources of medicine as far as it relates to the human body, and by disseminating it gratuitously in your neighbourhood, you will become the benefactors of your country.

For a while your knowledge in this branch of science, must be acquired by reading, observation and experiments; for as yet no societies or schools have been established for cultivating, or teaching it in the United States.

In all other countries, it has accompanied the advanced stages of civilization. In Greece and Rome, the necessity of offering such animals only in sacrifice, as were perfectly sound, added to the motives for taking care of their health. The Arabians cultivated veterinary medicine with nearly the same zeal that they did the medicine of the human body. In France and Germany the health of domestic animals, has for many years been a part of the studies of regular bred physicians. In St. Domingo, a society called the "Philadelphians," was established many years ago, consisting chiefly of physicians, whose principal business was to investigate and cure, what they called epizootic diseases, that is the diseases of domestic animals. They favoured the world with one valuable publication upon them, before the civil war in that island put an end both to their labours and their name.

A veterinary school has been lately established in London, under the patronage of some of the most respectable noblemen, private gentlemen, and physicians in the British nation. Already it has diffused a great deal of knowledge through Great Britain, particularly of the diseases of the horse. Of this knowledge, a considerable portion has fallen to the share of the farmers and farriers, much to the advantage of that noble animal!*

While I lament the want of a veterinary institution in our country, I am happy in an opportunity of mentioning that the diseases of domestic animals have not escaped the notice of the agricultural society of Philadelphia. They have recom-

*The Dublin society of arts have lately established a professorship of the veterinary art, and endowed it with a salary of fifty pounds a year, with a dwelling house for the professor, (Dr. Peel,) valued at sixty-six pounds sterling a year. Carr's Stranger in Ireland. p. 29.

mended the study of them in strong terms, in their late address to the physicians and citizens of the United States; and it would be an act of injustice not to acknowledge, that it was in consequence of the excellent remarks contained in the part of the address to which I have alluded, being impressed upon me with peculiar force by the enlightened and patriotic president* of that society, that I was led to select the interesting subject of our lecture for the present occasion.

But in vain will be the efforts of public bodies, and private individuals to disseminate veterinary knowledge in our country without a provision for regular and oral instruction upon it.

From the public spirit of the trustees of our University, and particularly from their disposition to promote every branch of science connected with medicine, there is reason to believe, that it is only necessary to lay before them the advantages of a veterinary chair, in order to insure its establishment.

Should the subject of the diseases of domestic animals, be connected with instruction upon the principles of agriculture, and implements of husbandry, so as to constitute what is called in some European universities, "œconomics," or a system of rural œconomy, it would form a still more useful branch of education, not only for physicians, but for private gentlemen. I have lived to see the medical school of Philadelphia emerge from small beginnings, and gradually advance to its present flourishing condition, but I am not yet satisfied with its prosperity and fame, nor shall I be so, until I see the veterinary science taught in our University.

One of the patriots and heroes of the American revolution, who died suddenly a few years ago, in his barn yard, said with his last breath to his servant who stood by him, "take care of the creatures." Nearly in the same words which dictated this kind direction, I shall conclude this lecture. TAKE CARE OF THE HEALTH OF DOMESTIC ANIMALS.

*Richard Peters, Esq.

MEMOIRS

OF THE

AGRICULTURAL SOCIETY

OF

PHILADELPHIA.

On Sheep. By John D. Steele, near Downing Town, Chester County, Pennsylvania.

Read June 11th, 1805.

THE illustrious Buffon has very justly observed, that " the sheep is an animal to man the most valuable, its utility the most immediate and extensive; it alone satisfies wants of the greatest necessity, it furnishes both food and apparel, besides the advantages arising from the skin, suet, milk, entrails, bones, and dung of this creature, to which nature seems to have given nothing as its property; all is to be delivered up to man." To this splendid catalogue of the valuable properties of sheep, an additional item may be placed, which enhances their value in a high degree to the farmers of Pennsylvania; viz. many of the weeds that disfigure their fields in autumn, furnish sheep with agreeable and nutritive food; few are refused by them, and rag-weed, *(Ambrosia elatior,)* they eat with avidity. This last advantage seems not sufficiently appreciated by the generality of

farmers, though the benefits that would result to them from keeping sheep where these weeds prevail, is too obvious to admit of illustration; whence it may be safely inferred, that the small quantity of sheep kept in Pennsylvania, is a misfortune and mistake in the rural œconomy of the State, that cannot be too much regretted, nor too speedily removed.

But there are many objections almost uniformly advanced against keeping sheep, by those who are unfriendly to the practice; one of which is the injury they do to pasture, and particularly, to young clover, by biting it too close to the ground, and by leaving it exposed to the too powerful influence of the sun and frost. Another is, the quantity of grass they consume, which it is contended is comparatively much greater than is eaten by other animals; and a third, is the danger they are exposed to, from the nocturnal depredations of dogs.

I admit there is much plausibility in the first objection, but experience has taught me to doubt its solidity. I have not thought it prudent to suffer any kind of cattle to go into clover early in the spring, when the roots are loosened by the recently departed frost; but at every other season my experience forbids me to think sheep injurious to pasture.

For the last six years, I have been in the practice of feeding large flocks of sheep, and have generally eaten the young clover in my stubbles very bare with them; but never found the succeeding crops perceptibly injured thereby, though they were frequently kept in the fields till the verge of winter.

The second objection appears equally as questionable to me as the first. I have never ascertained the exact comparative quantity of herbage that sheep will destroy, but if I might be allowed to use the quantity of fodder that will support them in winter as a criterion to judge by, I should conclude it to be in the proportion of nine to one with black cattle; for I found nine sheep, which I confined in an enclosure last winter, to eat no more than one cow would consume.

The last objection is beyond a doubt a formidable one, and requires the farmers utmost vigilance to guard against:—for a whole flock to be destroyed in one night, by a single dog, is not very uncommon. Guided by an instinct which cannot fail to excite admiration, he prostrates the terrified animal, and opens the jugular blood vessels, whence he sucks the vital fluid, till the spring of life is nearly exhausted, then leaves it, frequently with some slight remains of animality, and proceeds to feed his sanguinary appetite with the blood of the rest of the flock, which fall in succession, victims to his ferocity.

When the animals thus worried are found still living, people are apt to imagine that those parts of the carcase which have escaped the teeth of the dog remain uninjured, but this idea is erroneous. The meat has an extremely disagreeable taste, or smell, or both, which it would be not easy to describe, and perhaps equally as difficult to account for.

It is said if sheep are confined in a field in the night with black cattle, the cattle will protect them, but I have always thought it hazardous to make the experiment.—The plan which I have hitherto followed with success has been, to confine them in a yard contiguous

to the house; but a fold encircled with pales six or seven feet high would doubtless be preferable, and where timber is in plenty, this might be done at a light expence. If a fence of this description, were made moveable, it might be applied to folding in the field for the purpose of improving land.

In one respect sheep in their value to the farmer, have a decided superiority over black cattle. This never occurred to me till lately; when I was looking over a field that had been closely pastured by a large flock, I was forcibly struck with the manure they had left on the ground; not with the quantity, for this was perhaps not comparatively greater than would have been left by other animals, but with the equability of its disposure over the surface.

The dung of larger animals is generally dropped in a heap, and the benefit arising from it is confined to the particular spot on which it has fallen, which would have been sufficiently improved with half the quantity; and besides, in the summer it is more liable to the depredations of insects, and more subject to have its moisture exhaled by the sun beams than sheep's dung, for the latter incorporates sooner with the soil, the heaps being much smaller, and the granulations less.

Another advantage which sheep have over black cattle, is the shortness of the season they require dry fodder in.—They will do well in pastures so short, that black cattle* cannot live in them. Hence less expence is incurred in supplying them with hay.

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* The term "black cattle" is adopted from Professor Munro.

On Hoven Cattle. By Richard Peters.

Read July 9th, 1805.

The clover husbandry being now, happily for the parts of our country heretofore worn out and sterile, very prevalent, it behoves us to extinguish all prejudices, against this great and extensive improvement. One evil, attending luxuriant clover, whether plaistered or not, is immaterial; (though some have, without reason, supposed a difference,) is the subjecting cattle to become hoven, by too greedily feeding on this grass, when it is growing, or when cut, and given to them green, while it is wet with dew or rain.—Horned cattle particularly, when turned in hungry, though ever so much accustomed to clover, are liable to this misfortune.—Young and soft clover, loaded with dew or rain, is the most productive of this disease. They therefore should not be turned in, till after the dew or rain is exhaled. Beasts kept constantly in the field, are not in danger, in so great a degree; horses do not always escape. Swine and sheep, are also subject to this malady. Any succulent and juicy food, if moist with rain or dew, has a capacity to generate the air, which, by its expansion in the animal, produces hoving.—Lucerne, pea-vine, green indian corn plants, and buckwheat, have, under my own observation, occasioned this destructive complaint.

Symptoms. The paunch is so enormously swelled, that unless relief be promptly afforded, death ensues: in the last stages of this disease, the tongue hangs out of the mouth, the eyes are full and protuberant, and the

rectum (or last gut) is distended externally, sometimes four or five inches. The beast falls, and exhibits signs of the most severe pain and torture. Its groans are piteous and distressing.

Cures. 1st, Immediately stab the animal, on the left side, between the hind rib and the hip bone, not too near the latter, with a pen knife, or other small knife; stand near the left shoulder, with your left hand on the back of the animal, and perform the operation, two or three inches deep, with your right, to avoid being kicked, which sometimes, though rarely happens. If he lie down, the hind legs may be secured, for the moment with a cord; be not afraid of wounding the intestine. The knife must pierce the abdomen, to let the wind escape. If one incision fail or close, immediately make another; the operation has been repeated seven times, on the same bullock, in different distended parts of the belly, and succeeded at last.—It does not always wound the gut; as the wind is between that and the exterior parts. Vast explosions of wind, often very fœtid, with water of a reddish colour, will issue from the orifice. A knife sharp at the point, and not edged far, a short blade, or one wrapped round with cord or rags to prevent its going too deep, is the best. But be not nice as to this. The disease will be certainly mortal, unless instantly relieved; therefore think not any remedy too daring. A large butcher's knife has been used, when a penknife was not at hand. After the evacuation of wind through the incision, give a warm clyster. It may be composed of oil, fish pickle, molasses, and if no pickle, some salt. In the "*Museum Rusticum*" in 1764, and Mr. Wynn Baker's report to

the Dublin Society in 1769, a full account of this disease may be seen. It will effectually remove all prejudices against this remedy, which, if applied in time, is so certain, that not one in a hundred cattle thus treated, has been lost. I can vouch on my own experience, for the efficacy and little danger of the operation. Let nature cure the wound. Do not sew it up, or apply any thing except what will keep away the flies. 2d, A beast has been relieved by violent eructations, on the tongue's being suddenly and forcibly drawn out. 3d, Another instant, and very efficacious remedy, is raking the beast, and drawing out the superabundant fæces: this is well known to, and often practised by farriers. 4th, Another remedy, in the first stage, and frequently successful, and always useful as an auxiliary, after the more prompt methods before recommended have been used, is drenching. For this purpose take a pint of sweet oil, or if this cannot be had, raw linseed, or even train oil, or melted hog's lard. Sometimes salt and water have been serviceable, but these are too feeble in extreme cases. All these remedies may be applied, without incompatibility, to the same diseased subject. Half an hour, and frequently a less time, terminates the disease by death or recovery, therefore be expeditious; do not listen to those who tell you about danger from the knife. It may, and sometimes does fail.—But without it, your loss is generally certain. Some will suppose your beast poisoned; and not a few will dream, that it is a poison generated by plaistered clover; some, astonished at the suddenness, hideous symptoms and rapid progress of the malady, will pronounce, very gravely, that it is the effect of madness, or secret mischief and witchcraft.

However absurd they may appear to persons of intelligence, I have been present when such causes have been seriously assigned. All my endeavours to procure the application of prompt remedies, have been defeated by one or other of these vagaries. The knife is the surest remedy for, and antidote against, this imaginary poison. It instantaneously dissolves the fancied spells of the ideal practitioners in witchcraft. It banishes from the brains of those who prove themselves no conjurers, all apprehensions on this score; more decidedly and promptly than even the old horse shoe, nailed on the door sill. These latter observations are made with the sole view of warning the owners of stock, against the ignorance and prejudices of their subordinates or weak advisers, and to induce them personally to attend to the preservation of their cattle, on such sudden and dangerous emergencies,

On Rotting Flax. By Joseph Cooper of New Jersey.

Read November 12th, 1805.

About 18 years past I purchased a German servant man, and soon afterward set him and others to spread my flax; the lot not containing the whole, he requested me to let him rot the remainder in his own way; this he did, and the flax so rotted, proved the best, softest and whitest, I had ever seen, and the method pleased me so well, that I have practised it ever since, with some alterations as to time.—The process I find to answer best, is, after the seed is beaten off, to bind it in bundles about the size of common rye sheaves, and about the last of September or first of October, to immerse them in water, (stagnant water is preferable to running,) about two weeks, but the time should be regulated by the weather, as to heat or cold; it is then taken out and spread thin and even, and turned as often as occasion may require: after being spread, every rain, fog, dew, or frost, assists in separating the harl, whitening and softening the flax and extracting the gum, the detention of which is the only cause of flax being coarse and harsh. It is an established fact with those who have tried both ways, that either thread or cloth made from flax prepared in the above manner, is softer, and will whiten in one third of the time that is requisite for either article, made from flax rotted in the common manner.

I believe the principal reason why water rotting flax is so little practised in North America is, that those who have tried it, find the flax harsh and brittle, the cause of

which, (I imagine,) is putting it in water in hot weather, when two or three days will rot it sufficiently for dressing, but will not extract the gum.——

A person from Ireland, (who is well acquainted with the process of flax preparation,) informs me, that it was the common practice in Ireland about 20 or 30 years ago, to permit flax to remain in water until sufficiently rotted, but the people in general finding it did not answer their expectation, have since adopted the above method with success.—Linen made of flax prepared as before directed, with one boil, will be about the colour of Russia sheeting, which induces me to believe that all the hemp and flax in Russia is rotted in the same way.

See an account of the Irish mode of preparing flax, among the selected papers, at the close of this volume.

On Peach Trees. By Joseph Cooper of New Jersey.

Read January 14th, 1806.

In looking over an Almanack* for the present year, I observed a piece giving information, that peach trees had been preserved in the neighbourhood of Philadelphia, by removing the earth from the roots, after the first hard frost, in the fall, and returning it again in the spring, and oiling the body three or four feet from the ground, with common lamp oil.

The author likewise observes, that peach trees that stand in hedge rows and thickets, thrive better than others in cleared ground, which had suggested the idea, of defending the body of the tree, by wisps of straw, to prevent the attack of insects.

I take the liberty to make some observations on the piece alluded to.

In the first place, I think the taking the earth from the roots of peach trees, in the fall, dangerous, as I tried that method in the fall of 1779; the succeeding winter proved very severe, as to frost, and but little snow; the consequence was, the loss of every tree so treated, and their worms not injured. On examining the trees in the spring, I found worms abundant as usual, and the effect the removing the earth had on them, was, causing them to injure the tree more, by descending the roots, as the cold came on; they returned to the surface as the weather warmed, and in picking them out, I found

*Published by Kimber Conrad and Co.

the bark dead, up to the place above whence the earth had been removed, as if a fire had been made round the tree, and the top as fresh as usual; it however died, with the approach of warm weather. The observation, that peach trees flourish in hedge rows, &c. I know is accurate; they also flourish in most places where the body is shaded; this I attribute to their being preserved from the effects of the sudden transitions, from heat to cold, and from cold to heat, which I apprehend are more destructive to peach and cherry trees, than insects, as I have had hundreds of fine trees to perish in one summer, after an irregular winter, without being in the least injured by worms.

Among many reasons for the opinion, that irregular winters are destructive to peach trees, one is, that from good authority, said trees live in Cape May county in this State, to the age of 30 or 40 years; an age, which I attribute to situation, the county being half surrounded by the waters of the Atlantic ocean, and Delaware bay; and in the direction of the winds, that cause the warm spells here in winter, and which have not the same effect there, coming as they do, so immediately off those large waters; a proof of this is, that vegetation is generally two weeks later there than here, though so far to the southward.

From many observations and experiments, I have found that the worm most destructive to peach trees, begins to change to a *chrysalis* about the first of July, and remains in that state about two weeks, when they come out a wasp, and proceed to couple and lay their eggs near the roots of the trees, or in wounds in any other part; but do little injury, except in or near the roots as,

if attended to, the issuing of the gum will shew their seat, and they are easily picked out; but their principal object is the root, the bark being softer there than on the body, and the rapid growth of the trunk near the root, at the time of the wasps depositing their eggs, causes a number of small rents in the bark, which give the worms an easy entrance. I have observed that trees in a declining state, are more favourable, to the increase of peach worms than those of luxuriant growth, as the latter discharge so much gum from the wounds, as to cause the death of the insect, and the former will bring them into the wasp state a month sooner; for which reason I examine the peach trees carefully every spring, and those that are in such a declining state as to render them unprofitable, I hitch a team to, and draw up by the roots, as the most certain mode to destroy all the worms they may contain.

The best method I have yet discovered, to prevent injury from the worms, is to examine the trees carefully in the spring and take out the worms; repeat the operation about 1st July, and hill up the earth round the trees eight or ten inches: in October, remove the earth, examine as before, then renew the hill, which leave, till the spring examination. By continuing this process annually, I am confident that not more than one of my peach trees has been killed by the worms, for twenty that have died in consequence of irregular winters: and as I have observed the fluctuating state of the weather in winter, constantly to increase for more than fifty years, I conceive it must proceed from some certain cause, which I apprehend to be the improvement of the country, every cleared field operating, when free of snow,

as a reflector of the rays of the sun. That the clearing of the country is at least in part the cause of our variable winters, is rendered in some measure probable by a fact communicated to me, viz. that in the thinly settled parts of the country, peach trees flourish as well as they did formerly in the neighbourhood of Philadelphia: therefore it seems advisable to endeavour to find out some method to defend tender fruit trees from the effects of fluctuating winters; I can think of no better method to succeed, than binding straw round the body or trunk of the trees, that part appearing to be the seat of the disease.

On Peach Trees. By Richard Peters.

Read February 11th, 1806.

The last meeting of the Society was favoured with a communication on the subject of *peach trees*, from Joseph Cooper Esq. of New Jersey, whose experience has enabled him to add much to our stock of practical knowledge. I was desired to give some account of what had fallen under my own observation, relating to this valuable and delicious fruit. I know not any in the catalogue of our trees, more desirable, nor more subject to mortifying decay, disease and destruction. Having cultivated it from my earliest youth, it should seem that I could give some certain and profitable mode of remedying its tendency to premature decay, and repelling the diseases to which it is invariably a victim. But I have found myself so frequently baffled in my endeavours; and have seen the fallacy of so many theories, on this subject, that I diffidently affirm anything respecting its culture or cure. It is therefore only in obedience to the wishes of the Society, that I express my opinions or experience.

About fifty years ago, on the farm on which I now reside, my father had a large peach orchard, which yielded abundantly. Until a general catastrophe befel it, plentiful crops had been for many years produced, with little attention. The trees began nearly at once to sicken, and finally perished. Whether by the wasp then undiscovered, or by some change in our climate, I know not. For 40 years past, I have observed the

peach trees in my neighbourhood, to be short lived. Farther south, in the western country, and, it seems in some parts of New Jersey, they are durable and productive, as they had been formerly here.*

In my youth, excellent *plumbs* grew here; now we can obtain none, but those of inferior species. In *grapes* we were never successful; though much more so than at present. Our *wheat* in modern times, is attacked by enemies unknown to our predecessors. Our *apple orchards* do not produce, as they did in early times. There must therefore be some change in our climate; and new races of vermin, not known to our ancestors. In cities and towns, *grapes* and *plumbs* and I believe *peaches*, are in high perfection. The atmosphere in which they vegetate, possesses a character favourable to their growth; and their position admits fewer enemies to assail them. I am aware that it is a frequent mistake, to draw general conclusions, from partial facts. My opinions are formed on experience, I have gained on my own property, and may not generally apply. I have near 1000 apple trees, 150 grape vines, 200 peach trees, and a number of plumbs. They are of all ages, kinds and exposures; and set out in every variety of soil. I have endeavoured to practise on every information to be acquired from books, or oral directions. I must therefore conclude from my frequent disappointments, that

* I have seen them also in great perfection, in and about Lancaster, and other parts, where limestone and other calcareous substances abound. The cause I do not pretend to assign; nor do I know the general duration of the tree, in that country.

fruits in this part of the country, are uncertain in product; and have declined, in quantity and quality, in a degree not formerly experienced. I have often observed, that in bad fruit years, the seasons were unhealthy for animals. *Insects* and their *larvæ*, or catterpillars, and other enemies to fruit, abound in such seasons. The products of the earth seem to be more favoured at one period, and in different stages of the settlement of our country, than at others. Advantages or misfortunes, merely local, have their influence. Some are perfected in old settlements; others thrive only when the earth is recently reclaimed from the wilderness of nature.

Of the *peach*, I have 32 varieties. Mr. Coxe, of Burlington, has double that number. But those I have are sufficient to enable me to form a general idea. I find some less exposed than others, to misfortune and decay. It would therefore be desirable, to mark, and cultivate those most commonly, in which the most success could be counted on. Mr. Cooper has been successful, on this plan, in other products. Let him, and other curious cultivators, practise on this suggestion.

I have failed in many things, in which others are said to have succeeded. Straw and bass, or paper, surrounding the tree, from the root, at all distances, from 6 inches, to 3 or 4 feet—white washing, painting, urinous applications, brine, soot, lime, frames filled with sand, oil, tar, turpentine, sulphuric acid or oil of vitriol, nitrous mixtures, and almost every kind of coating. I ruined several trees, by cutting them down, and permitting the stump to throw up new shoots, and branch at pleasure. All teguments kept the exsudation from

evaporating with freedom. The pores being closed, or too open, were alike injurious. Teguments of straw or bass made the bark tender; and it threw out under the covering, sickly shoots. The more dense coating stopped the perspiration. The oil invited mice and other vermin, who ate the bark thus prepared for their repast and killed the tree. I planted in hedge rows and near woods, I paved, raised hillocks of stone—I have suffered them to grow from the stone only, grafted on various stocks and budded, hilled up the earth in the spring and exposed the butt in the fall, sometimes I have used the knife freely—frequently have left the tree to shoot in every direction—I have scrubbed the stocks or trunks, with hard brushes, soap suds and sand, scraped them with proper instruments: I have, for a season or two under various experiments, amused myself with the persuasion, that I had discovered an infallible *panacea.* I had temporary success, but final disappointment.

The *aphis* or vine fretter, and many other insects are hostile to this tree. They injure it, by piercing, curling, and destroying its leaves. As to *frosts*, they are common enemies to all fruit.

Having thus candidly given an account of my failures, which never discourage, but animate me to new projects, I mention what with me has been attended with the most success.

The worm or grub, produced by the wasp, depositing its progeny in the soft bark, near the surface of the ground, is the most common destroyer. I remove the earth, a few inches round the tree in August or September. After July the wasp ceases to pierce the bark,

and to make its deposits. I pour around the butt of the tree, beginning about one foot above the ground, a quart or more (not being nice about the quantity) of boiling hot soap suds or water. This kills the egg or worm lodged in the tender bark; and of course prevents its ravages the next season. I carefully search the trees, though I seldom find worms. I do not perceive any injury from this operation. I have discovered worms in or near the roots of the smallest stocks taken from the nursery. These I frequently plunge into boiling water, before planting. I lose very few; and do not attribute the losses to the hot water. I have the trees bared at the roots, exposed to the winter. I have lost some in the way described by Mr. Cooper; but I still continue the practice. I have been in the habit of doing this for ten or twelve years, and prefer it to any other treatment. To supply deficiencies, I plant young trees every year. By these means, I have generally fruit enough for my family, and frequently very abundant crops. How long I shall continue to prosper by this practice, is yet problematical. I have now some of the most healthy trees I ever possessed. When trees become sickly, I grub them up; I find that sickly trees often infect, those in vigour near them, by some morbid effluvia. The young trees supply their loss, and I have no trouble in nursing those in a state of decay; which is commonly a hopeless task.

I have been thus particular, to justify the inference from this statement—that, in this part of the country peach trees cannot be profitably cultivated on an extensive scale.—But we may have great abundance of their delicious fruit, in every variety, if every farmer

and horticulturist, would plant the number, to which he could attend, without interference with his other concerns. He might keep up a constant succession, by setting out a few every year. Our grain, and garden plants in general, require renewal annually; and peach trees require no more trouble. A tree with very little attention, will produce three or four crops. Its growth is quick; and it may be propagated easily, and come to perfection, in any soil of tolerable staple. As the older trees decay, or grow sickly, young and vigorous trees will begin to bear. The method which I have lately pursued is simple; guards against the worm, and affords me a plenty of fruit. I do not mean to discourage perseverance in experiments, which may yet succeed. We must never part with hope; though she seduces and "cheats us o'er and o'er again." The ants of Grenada were exterminated by a single tempest.

Although I have had trees 20 years old, and I know some of double that age, (owing probably to the induration of the bark rendering it impervious to the wasp, and the strength acquired when they had survived early misfortunes) yet, in general they do not live in tolerable health after bearing 4 or 5 crops. And being among the most gummy, viscous, succulent and tender of our fruit trees, they require from the earliest stages of their growth more labour and attention, than could be profitably applied to an extensive plantation. I have too many to be sufficiently attended to; but a number of them, by their present appearance, warn me not to be uneasy on that score. The shoots of the last season were remarkably injured by the excesive drought; and the extremities of many limbs are entirely dead. I

shall have, however, more than I require for myself, my friends, and my foes. I have a superfluity, to afford deductions made by plunderers; for whom (from necessity) I plant an extra number. The trees now verging to their last stage, are chiefly those set out in the locust year. They have never recovered the wounds, inflicted by this most pernicious of all insects.

Fifteen or sixteen years ago, I lost one hundred and fifty peach trees in full bearing in the course of two summers; by a disease engendered in the first season. I attribute its origin, to some morbid affection in the air, which has the most to do with all vegetation, as well in its food and sustenance, as in its decay and dissolution. The disorder being generally prevalent, would, among animals have been called an epidemic. From perfect verdure, the leaves turned yellow in a few days, and the bodies blackened in spots. Those distant from the point of original infection, gradually caught the disease. I procured young trees from a distance, in high health, and planted them among those the least diseased. In a few weeks they became sickly, and never recovered. I took the determination of grubbing up every peach tree, and converted them into fuel. In my own nursery, perceived I should have an hospital of incurables. The young peach trees being generally infected, I cleared the whole of them away. Various kinds of fruit trees, in the same nursery, were not in the least disordered. Trees, like animals, have inherent diseases, or a susceptibility to receive those, peculiar to their species. The peach seems most subject to this tendency; pears are liable to blights from the electric fluid. Iron hoops, old horse shoes &c. hung on these trees, attract and con-

duct for a time, this floating fluid. But when the air is surcharged, destruction partial or total is certain. Cherries are fatally operated upon, by what is called the four o'clock sun. Plumbs too are exposed to peculiar disasters, which would lead me too far to detail; though I have paid much and unprofitable attention to them; and have, now and then, hit on temporary palliatives. Particular insects and vermin have their respectively favorite tree, or plant to prey on. They pursue the dictates of nature, for their own propagation and support; while, by destroying our sustenance and comforts, they become hostile to us. They compel us to wage against them a perpetual warfare.

After my general defeat and most complete overthrow, in which the worm had no agency, I recruited my peaches from distant nurseries; not venturing to take any out of those in my vicinity. I have since experienced a few instances of this malady; and have promptly, on the first symptoms appearing, removed the subjects of it, deeming their cases desperate in themselves, and tending to the otherwise inevitable destruction of others.

POSTSCRIPT.

I have only recently seen, or I would have mentioned with my communication, an extensive plantation of *peach trees* (now in vigour and very productive) by Edward Heston Esq. in my neighbourhood. It is well worthy of inspection, and its design exemplary; the

scale being larger and more spirited than of late years, we have been accustomed to see, in this part of the country. I conjecture there are 7 or 800 trees, planted in rows or lines; so that the branches interlock, and are suffered to shoot without controul. The intervals between the rows are wide, and cleaned with the plough and harrow. As is to be expected, the fruit though plentiful is small; and wants flavour equal to that of more distant trees. They grow from the stone, and Mr. H. occupied in his plan, did not attend to the selection. He is now improving by inoculation, and providing better kinds. In an imitation of this commendable effort, I would advise a little more distance, and more use of the knife; but not so much as to thwart nature. I would not entirely depend on inoculation. Planting the stone is more certain, as to quick growth and earlier profit as well as œconomy; though it does not insure identity of species. Mr. H. begins to suffer by the disease, I call the "yellows;" though he has fewer worms, than common in other modes. The wasp from which the worm proceeds, does not of choice, frequent shady places. I do not know any product more valuable than peaches, to which the same extent and quantity of ground could be applied. To ensure constant supply, another plantation should be progressing, while that in profit is bearing and declining. It should be distant from the first, to be out of reach of infection. Why should we not cultivate, in this way, this fruit, when other products are equally long before profit is obtained? Madder, liquorice, &c. require as much time, and better ground. Their certainty or superior profit is questionable. By the mode here mentioned,

constant successions may be counted upon, without the toil and disappointments of attempts, to prolong the duration of this short lived tree. I perceive Mr. H. is travelling the same road of experiment, to save declining, or insure healthy trees, I have passed over behim. He will be fortunate, if he does not meet with similar disappointments.

September, 1807.

As I predicted, the "*yellows*" are seen making destructive ravages in Mr. Heston's peach plantation. I have lost a great proportion of my trees, by the same malady, this year. Some of them were young and vigorous. We have had two successive rainy seasons. I do not recollect ever to have seen more general destruction among peach trees, throughout the whole of the country. It seems that excessive moisture is one, if not the primary cause of this irresistable disease.

On cutting off the horns of Bull Calves. By Paul Cooper, of Woodbury, New Jersey.

Read August 12th, 1806.

The method is, when a calf is about a month old, and the horns have risen above the skin, to cut off the knobs close with a chisel, and with a sharp gouge, pare them clean from the bone: then sear the wound, and fill it with sturgeon's oil, or hog's lard.

Cattle often acquire such dexterity in throwing down fences with their horns, that if they are chained, head and foot, to prevent their jumping; they will nevertheless, with their horns, throw the fences down to the ground; and by that means, let a great part of the stock, perhaps in the night, into your field of corn or wheat. Cattle often learn to lay down bars, open stable and barn doors, gates, &c. with their horns. I have known them a number of times to get into my barn by this means, in the night, when I have had a large quantity of grain on my barn floor. Bulls and cows not only gore each other, but very frequently wound horses; I have had several dangerously injured in this way, and a neighbour of ours lately had a horse, that I think he gave $ 900 for, killed by a bull. Bulls even gore children and grown people, many cows too are dangerous to milk on this account.

It is materially important, that the above operation should be performed on all bull calves that are not castrated. If this method were practised a few years, I think we should be so fully convinced of its utility, that legislatures would apprehend it conducive to the public

welfare, to impose a fine on all such who neglected to cut the horns of their bulls when young.

[The inconveniencies mentioned by Mr. Cooper, might be obviated by encouraging the polled or hornless breed of cattle. Another advantage would attend this breed, viz. that they would be free from the *hollow horn*, a disease which frequently proves fatal, when not duly attended to. In England, this breed, which is almost universal in the great farming county of Norfolk, affords the greatest milkers.]

Departure of the Southern Pine Timber, A Proof of the Tendency in Nature to a Change of Products on the same Soil. By Richard Peters.

Read September 9th, 1806.

Belmont, August 30th, 1806.

Sir,

I have formed the outline of a plan, which, as leisure may permit and inclination prompt, I propose more maturely to digest; and, in which, I request and invite the members of the Society to assist. The object of it is, to illustrate and enforce the leading principles of good husbandry, proved on experience to be just, by facts, and reasoning deduced from them, taken from the great movements, or less operations of *nature*. She is the best and wisest instructress; because she is moved and governed by the all wise creator and governor of the universe. Our task must be to follow her dictates; and apply her precepts and example, with due discretion and judgment. This mode of disseminating agricultural knowledge, appears to me best calculated to convince the understanding, and rouse the attention of those, for whose benefit such associations, as that we have established, are intended. To give a specimen of the mode I have in view, (in which I have been more diffuse, than on subsequent occasions may be deemed requisite,) and excite more able exertions in others, I send the inclosed communication; which, with this explanation of my motives, I request you will please to lay before the Society. There are few, if any of us,

who cannot furnish some materials, for such a design. Facts may be collected, when the mind is turned to an object, which would otherwise pass without observation or useful instruction. If, in the prosecution of enquiries of this kind, some ideas may appear speculative, and visionary, they may nevertheless lead to practical and useful results.

I am, Sir,
Your obedient Servant,
RICHARD PETERS.

DR. JAMES MEASE,
Secretary, Agric. Society, Philad.

There is an account in the public prints, of the general decay of the *pine woods* in South Carolina; effected by a disease, which commenced in 1802. It would be highly useful to ascertain and record the facts, relative to this catastrophe. It has fallen under my observation to know, that this phenomenon is not rare, or singular. Intelligent surveyors, who have been occupied in running out new lands, in Pennsylvania, and other States, remark, in a variety of instances, a total change of timber, in many extensive districts of the wilderness. They discover by the fallen timber, coated with a diversity of the *mosses* (by which the air, and other means of decay, being excluded, they were the better preserved*) that the present forest trees are entirely different

* Coating, or covering large timber, before the acid sap is evaporated, is destructive. After it is seasoned, protection from exterior injuries, is beneficial. The *moss*, must,

from those of the former growth. Those prostrate are in many instances, of the resinous tribe, where those of a totally different kind are now growing, of enormous dimensions; in sites where white pine, pitch pine, and hemlock, had formerly possession; so that the living timber must be very antient.* The largest trees ma-

on those the best preserved, have established itself after desiccation. Where the covering has been premature, these trunks have been converted into vegetable mould, by the fermenting and feculating of the sap, confined and prevented from evaporation. Some of them, in the shapes or forms of fallen trunks of trees, have the consistency and texture of green hillocks, of rich earth. Some trees may have been blown down by tempests, in critical stages of the sap, when timber is most liable to rapid decay.

To prevent the *heart rot* in timber, *boring* through the center, longitudinally, is effectual. *Quartering* and *sawing, through the heart*, are also preservatives, if afterwards, the parts be artificially joined; and grooves, or passages, left, or made, for the admission of air.

* The growth of timber is, in our climate, so rapid, that in 25 years, it is of size sufficient, for every purpose commonly required; and possibly, on this account the less durable. Some years ago, when attending the subdivision of a body of lands in *York County*, I measured an oak growing out of a cellar of a ruined house or cabin, which had been inhabited 35 years before. The tree was near two feet in diameter. Around this ruin, there was a beautiful wood, of healthy and thriving timber; standing where grain had been raised, by the occupant of the building. The traces of inclosures were evident, through the woods; and some of the rails were not decayed. At iron works, they cut, for charcoal, the second growth of timber, after a lapse of from eigh-

jestically flourish among the fallen trunks of their predecessors. Those of us who have traversed our distant forests, especially beyond the mountains, where the timber is truly gigantic, must have noticed this striking circumstance. The variegated verdure of these immense recumbent trunks, numerous and extensive, affords to the traveller, a curious, pleasing, picturesque, and stupendous contrast, with the dusky glooms of the shades surrounding him.

In my memory, on a smaller scale, a total change of timber has occurred, in a tract of mine, containing about 800 acres in Northampton county. Previously to our revolution, perhaps 35 years ago, I knew it to be covered with *pitch pine*. It was called the *pine tract*. This first growth of timber having been blown down by a tornado, was consumed by fires of the woods, a practice mischievously common in that quarter. It is now entirely reclothed with *oak*, *hickory*, and other valuable well grown and thriving timber; and scarcely a *pine* tree is to be seen. I can give (within my own knowledge) several instances similar, but of less extent. One, of a fine grove of *white pine*, thrown up spontaneously, on old fields, where no timber of that species had

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teen to twenty five years. Our forest timber is produced spontaneously, as we all know. No pains are taken to plant, protect, lop or prune it, as is the custom in Europe. We take the opposite course: we not only neglect, but assist dissolution in its natural march, by wanton waste. Posterity will look back, with keen regret and reproach, when they feel the effects of our careless indifference, and culpable inattention, to their interests and necessities.

originally grown; and far from any such timber. Another, of a large body of valuable *chesnut;* where a person, now living, has reaped wheat, and other grain; and where *hickory* and *oak* had been the precedent growth; and no timber but of the latter kinds, is now to be seen in the adjacent lands. May it not therefore be probable, that a change in the timber of the southern country is about to take place? Dissolution and renovation, are constant operations, in nature. Some whole races of animals, have become extinct. The *mammoth*, the former monarch of the woods, is a proof, in the knowledge of every body. Beasts of a very different race, now occupy his haunts. Yet this had excited more curiosity, than important research, or useful enquiry.

I do not find that the particular species of timber growing on land, invariably designates its qualities, or strength: although it is certain, that some kinds are the most frequently found, on lands of similar quality. I have known *hemlock*, white *pine* and pitch *pine*, grow on very rich, deep stapled, and strong land; as well as on the most sandy, thin and sterile soil.

I mention these facts, and the opinions resulting from them, to invite attention to this subject: so as to extract from this trait in natural history, something auxiliary, and useful to the objects of our association. It behoves us to gain improvement, from the shifting of the grand scenery around us. Important movements in the system of nature, should not be suffered to pass, without profitable instruction.

Although some respectable agriculturists will not concede the point most generally agreed, to wit:—that changes of both animals and plants, are necessary to

their amelioration, or as preventives of degeneracy, I have always been of that opinion.* Selecting the best seed from vigorous plants on the same farm, is a substitute for change. Indeed it may be called a change, as is that of selections from the same breed of animals. But I have never considered this as a decisive proof of the doctrine, it is intended to support. It is an instance of commendable and exemplary attention, but its result would be more easily attained, by conforming to general experience. The same kind of seed, sown on the same farm, in soils of different textures and qualities, will ameliorate. Thus *sand* ameliorates and recovers, what in *clay* had degenerated; and so *vice versa.* A change of soil operates like a change of seed. I have ameliorated wheat, and other grain and plants, taken from crops in low land, on my own farm, without selection of the best grains, by sowing them on distant and

* In *agriculture*, a collection of practical facts only, is to be depended on. Solitary instances are often deceptive, more so are speculative opinions. Yet these have their use, as they lead to experiment and enquiry. Sir *Joseph Banks* asserts, contrary to general experience, that light, or shrivelled, grain, will produce as healthy a crop, as the best seed! In this it should seem that Sir *J. Banks*, was a mere theorist. It shews, however, what opposite opinions are entertained on the same subject. Mr. *Joseph Cooper* whose practical opinion has great weight (though I do not entirely agree with him in his conclusion, not doubting the fact he alleges) holds the direct contrary doctrine. He thinks that the selection of the *best seed* from his own crops, which is highly commendable, answers all purposes.—*System may be carried too far*, on both sides of this question.

higher grounds. The same breed of animals, shifted to distant and *different** parts of a country will recover a degenerate race. Both these facts, as they apply to plants and animals, have been experienced by me, and multitudes of other farmers.†

Nature, the creature and agent of the divine author and director of all things, without intermission, when special interferences do not occur, (which they who do

* "*Different*" is here to be understood, from high to low lands, and *vice versa*. Also as to herbage, and texture of soil,—such as, from salt marsh, to fresh grass &c.—Sheep with the *rot*, and other diseases, have been cured, by change from *fresh pastures* to *salt marshes*.

† The careful attention of some *Europeans*, to the *breeding system*, may, like a selection of grain for seed corn, be, by such judicious selection, a substitute for changes. They are not however, there agreed, what is the best course for continuing, preserving from deterioration, or improving their valuable animals. Great success has attended a few celebrated breeders, in different modes. Some are attached to *crosses*, others hold it unnecessary and injurious; and select the best and finest stock for breeders, from the same family. In this country, where little knowledge of, or attention to this system exists, the shortest and best mode is to change, either locality, or stock. But in no case, should either the original stock, or attention to it in its progress, be neglected. Our time and labour are engaged so unremittingly, in our common affairs, that the necessary application to nice selections, cannot often be afforded, by the mass of farmers. If the result can be produced, with the same application, as profitably, it will be immaterial and a mere speculation, whether selection be considered a substitute for change, or change for selection, of either stock, or grain.

not often perceive, must be indeed blind) progresses in a system prescribed to her; and employs various instruments to effect her purposes. The most flagitious of the human race (who also perish in their turns,) are frequently impelled to exercise, a subordinate agency to chastise, destroy, and finally to produce a *change*, *renovation*, or *substitution*, in *nations*, or *races* of men. What immense numbers of our species, have, out of the common course of mortality, and prematurely, to our short sighted apprehension, been utterly destroyed! How many of the *aborigines* of *South America*, and the islands near it, among other instances ancient and modern which might be imported from *Europe* and other quarters of the old world, have been extirpated! Nearer home—in our part of this Continent, in the spot we now inhabit, the more modern theatre of a tragedy in which *Europeans* and their decendants, have been the chief actors—whole tribes, and nations, have been exterminated! Their names are not known to us, who now possess their soil. Their places are now tenanted, by those destined to extinguish and succeed them. *Vermin* and *diseases*, of infinitely diversified descriptions, are employed, for the purposes of change, and thereby to effectuate the inscrutable designs of heaven, to prostrate the most exalted, as well as the most humble, of the animal and vegetable creation. The pride of the forest, the riches of the field, and the ornaments and delights of the garden, are alike their victims. *Tempests* and *inundations*, ravage, with resistless ruin. The messengers of destruction spare neither the palace, nor the cottage. They deal out desolation, in a system of perfect equality!

This *picture* may not be valuable for its *colouring:* but the likeness is drawn by history and experience, with the pencil of truth. Nor is it gloomy, to those who succeed this winter of dissolution. They enjoy fruitful and renovated seasons; when new products, more vigorous and estimable, are benignantly sent forth, to retribute for those lost, by either sudden or progressive, but inevitable, decadency. Nature will have her course; and to her, an age, is but as to us a day.

For the distribution, supply and succession of *animal and vegetable productions*, means are established, in endless diversities; as well as to operate the changes designed, in the ordinary, or special course of progression. The *human race*, though endued, by the beneficent author of our existence, with the like organization of our system, both corporeal and mental, with that of our first parents, is nevertheless disposed to great varieties, in the branches from the original stock. These are numerous and operated upon, if not produced by climate, means and quality of subsistence and other local circumstances, as they are dispersed through different quarters of the earth; like the trees of the forest or the plants of the field. Although none of the human species may be said to be, in their nature, strictly indigenous, as it respects any particular hemisphere, or district of the globe; yet they become, in due time, accommodated (as are other animals) to the situation, in which they are doomed to live; and successions, and changes, of individuals continually occur. A diversity in their successions is seen, as one race, or variety, is located, or displaces another. The power of locomotion is given to us; and a disposition to change, is implant-

ed in our nature. A propensity to wandering, is not confined to savage tribes, it shews itself in those deemed civilised; who follow the worst and most savage propulsions, when they establish themselves, when nations are devoted to chastisement or overthrow, on the ruin, total or partial, of those they subjugate or destroy. And, whether the purpose be achieved progressively and peacefully, or violently and promptly, by those encircled with diadems, leading hosts, in the pomp, and fearful equipment of war; or by bands, or hordes, of savages, not less destructive and fierce, though less gaudily attired, or formidably arrayed, the same ends are accomplished, though the means are apparently dissimilar. Thus also, violence, decay and dissolution, and operations both awful and disgusting, are the precursors of the changes in *timber and plants*. These flourish on the destruction of others, to which they succeed; as do men and other animals, whose numbers and vigour encrease, by changes of race, or locality.

It is peculiar to *animals* to be endowed with the capacity of self movement, when choice or necessity invites, or compels, changes of locality and habits: and, by the exercise of their own powers, and propensities, *man*, and *other animals*, are distributed through every clime. The strong disposition, in minds rude or cultivated, for travel, and visiting distant countries, disguised under an infinity of motives, either of curiosity, improvement, cupidity, or ambition, is but an evidence of this natural impulse in men. A similar instinct for roaming and wandering, appears in other animals; when they are invited to change their haunts, in pursuit of prey, in search of more sunny regions, and temperate seasons

or greater plenty of subsistence. Such propulsions are stimulants to the execution of the great designs of heaven to *replenish* and *populate* the earth; and to spread through every region, the *tenants of the forests*, and *the beasts of the fields*. The migrations of *birds*, and winged *insects*, are easily effected: and the *animals appointed to inhabit the "vasty deep,"* are in constant progress, through its immensurable expanse.

For the dissemination of the *vegetable tribes*, their all wise creator has instituted countless means. *Animals* winged and footed, *winds* and *waters*, are subservient to their propagation. In the wonderful machinery of nature, one part is always assistant to the other. Hence we can account for a few and rare appearances of trees and plants, in unexpected spots.—But how, or from what germes, or organized particles, new and extensive products spring forth spontaneously; in situations very distant from any of the same kinds, where none such were before seen; and where a distinct vegetation had long occupied the site;—is hidden among the *arcana* of the creation, into which I do not presume to enter;—much less to explain. The facts are numerous and indubitable:* and, if I can fairly deduce any practical, and profitable conclusion, it is all I aim to accomplish.

* Since this communication I have met, accidentally, with a critique in the *Edinburg Review*. Vol. I. 1802–3. on *Mackenzie's Voyages*. It calls to my recollection a confirmatory fact; mentioned by him. He alleges it to be "a very curious and extraordinary circumstance, that land covered with *spruce pine* and *white birch*, when laid waste by fire, should subsequently *produce nothing but poplars*, where none of that species of

The *corollary* to be drawn from these observations, *is practical.* Speculation is vain and visionary, when it does not assist in the practical business of life. *Let agriculturists be warned, by the decline of plants or animals, to change their course.* When *crops* are repeat-

tree was previously to be found." The reviewers speak incredulously of this fact, which is nevertheless undoubtedly true; and corroborative of similar relations. Many of the *phenomena* of nature pass so often without notice, that they appear incredible, when our attention to them is awakened. We are yet novices in these secrets, which, with all our pride of science and experience, are hidden from our ken. We can but seldom agree about effects, much less do we accord in developing causes. It is almost as extraordinary, that *any* timber should grow, where, at the depth of four inches from the surface, he *(Mackenzie)* uniformly met with a solid body of ice, in midsummer: but this is not a solitary instance.

The savage and ruinous custom of *firing the woods*, against which our laws have feebly provided, is borrowed by our borderers, from their predecessors the Indians. It not only prevails where *Mackenzie* found it, in the northern regions of our Continent; but through the southern and middle districts of the wilderness, possessed by the natives, and their half civilized successors. The partial and temporary benefits of pasture, or facilities to hunting, serve as excuses for an enormity, which renders extensive tracts of country, originally valuable, finally desert, sterile and worthless. No depredations on personal property, are so destructive, as this most atrocious and irreparable offence. Timber will not grow, or thrive, where fires of the woods are frequently repeated. The change of timber, from a species destroyed, to one entirely different; is by no means confined to those places, where fires have caused the destruction of precedent growths.

edly destroyed or stinted by vermin, by too long cultivation of the same species on the same field, or other causes; or *animals* are deteriorated, by disease, or imperceptible causes, let an entire *new course, and species of crops*, be adopted; and a *different breed* of the same kind, or of another description of *animals*, be substituted. In a lapse of time, the same career may be ran over again. This is but extending, through the whole scene, the lessons of experience, taught by nature. A continual sameness of crop, in the same field, soon produces degeneracy and poverty. *Successions* and *changes*, are the steps to prosperity. Instead of uselessly repining under the visitations, with which we are occasionally, and, for our listlessness, deservedly punished; when the most apparently contemptible *insects*, desolate our fields, and *blasts* and *diseases* disappoint our hopes by frequent recurrences, we should profit, by *mementos*, thus strongly marked for our instruction. Growing wiser by misfortune, we should be convinced—that *nature calls loudly, for her expected and salutary change, of the objects of our industry and care.**

Belmont, August 30*th*, 1806.

* It seems almost unnecessary to mention, that, in this *change*, the quality of the soil must be consulted, and the course adapted accordingly. Nature delights in change; yet she will not be violently forced. In a new clearing, neglected, or not judiciously managed, it is curious to observe the infinite variety of plants, spontaneously thrown up. *Herbaceous* plants, are products of the first efforts, to clothe the surface; after the timber has been removed. These are generally,

In some degree connected with the foregoing subject, I think it useful to recall the attention of the Society, to the communication, I made, at their request, on *peach trees.* The contagious disease, I therein mentioned, as having given me some monitory indications, has verified these warnings. I have lost a great number, in the manner described, without the agency of the worm. I shall take my old course of eradicating the disease, by removing its subjects. I shall use none out of my own nursery, but procure young trees from a distance, beyond the scene of infection. I observe, throughout my neighbourhood, the same disease, producing the like destruction.

R. P.

(though there are wandering exceptions) suitable to the soil. *Aquatic plants* will not be found in arid situations; nor *vice versa.* The next step is to recover *timber.* This occurs in new, as well as old lands, when timber had been thereon originally. In *glades*, *prairies*, or places not naturally woody, it is otherwise. The timber, though often changed in species, is adapted to the qualities of the soil. So is the *herbage* of the lands, to which nature has denied timber. This should be attended to, in artificial plantations.

See *St. Pierre's* studies of nature; *(Beauties of the Studies.* 108.*)* for an handsome description of the operations of *nature*, when resuming her violated domain.

Supplement to the foregoing.

The cause of the rapid and alarming decay of the pine timber in South Carolina, is an insect or bug which was first observed in the northern and eastern parts of the State about six years since. It is a small black winged bug resembling the weavil, but somewhat larger. A great number of these bugs have been observed in the spring of the year, and early in the summer, flying near the roots of the trees: they pierce the bark a little distance above the ground, and lay their eggs between the bark and wood; in a few weeks after, these eggs hatch, and a worm appears, which at its full growth, is about an inch long: they immediately begin to feed on the sappy part of the tree, and do not cease eating until the whole of it is destroyed.

Very considerable injury has been done by these insects to the pines of South Carolina. In one place, viz. on the Sampit creek, near Georgetown, in a tract of two thousand acres of pine land, it has been calculated that ninety trees in every hundred have been destroyed by this pernicious insect; the adjoining lands, and many tracts on the Santee and Black rivers have equally suffered. The fact of an oak springing up in the place of a fallen pine tree, and of the latter appearing when the former is cut, in the southern States, is known to every one there.

The indelicacy of the Edinburgh reviewers in expressing their disbelief of the fact related by M'Kenzie, is the more inexcusable, inasmuch as their own country exhibits a glaring fact analogous to that of the intrepid voyager. I allude to the production of white clover,

without seed being sown, upon the wretched poverty struck heath and moss ground of Scotland, merely from the influence of lime spread on the surface. Mr. Hearne says, that "strawberries of a considerable size, and excellent flavour, are found as far north as Churchill river, and that it is remarkable, they are frequently known to be more plentiful in such places as have formerly been set on fire. This is not peculiar to the strawberry, for it is well known, in the interior parts of the country, as well as at Albany, and Moose forts, that after the underwood and moss have been set on fire, raspberry bushes and hips have shot up in great numbers on spots where nothing of the kind had ever been seen before." —*Journey to Northern Ocean, page* 452. *Lond.* 1795,

Mr. Cartwright also observes, "that if through carelessness of those who make fires in the woods, or by lightning, the old spruce woods are burnt, indian tea is generally the first thing which comes up: currants follow next, and after them, birch."—*Journal of Transactions at Labrador. Vol.* 3. *p.* 225.

The following extract of a letter to the writer, from John Adlum, Esq. of Havre de Grace, Maryland, dated September 16th, 1807, is a further confirmation of the point here in discussion. Every one who knows the high authority of Mr. Adlum, as an accurate observer, will duly estimate the facts he details.

"As to your query respecting a rotation or succession of forest trees, I am as well satisfied of it, in my own mind, as if I had lived to see the whole change for centuries back; and although it may be difficult to give the kind of information, that may be satisfactory, I have no doubt that I could convince any person as to the fact, were he to travel over the country with me."

"I first took the idea in the summer of 1788, when I was surveying lands south of the great bend of Susquehannah, between that river and the Delaware, in what is called the beech and sugar maple country. In the course of my surveying, I traversed some places, consisting of a few acres each, growing red and white oak trees of an enormous size, none being less than sixteen feet in circumference, five feet above the ground, and generally from 40 to 50 feet to the first branches; some few red oaks, were 22 feet in circumference, and the white oaks 20 feet round. I was struck with astonishment to meet a few trees of the oak kind, considering that I had not seen any for some weeks. After discovering the first few, I kept a look out for more such places, and as well as I can remember, I found two more of the same kind, containing trees of the same enormous size, but no small oaks nearer than the large waters emptying into the Susquehannah and Delaware. The places mentioned, were near the heads of those rivers, and where the streams were small, I invariably found small bodies of very large hemlock* trees (the prevailing timber,) near those places; the remainder of the trees consisted of beech, sugar maple, with a few white walnut,† white ash, birch &c. but no oaks."

"In those parts of the country, where the prevailing timber consisted of sugar maple, beech, and birch; I observed large trees growing as it were on stilts, their roots being three feet above the ground, which trees undoubtedly grew on old logs that had either fallen with

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* *Pinus Abies Americana.* † *Juglans Alba.*

age, or had been thrown down by hurricanes, and had rotted away from the roots of the trees."

"The clumps of oak and hemlock are generally in the midst of, or surrounded by large bodies of beech and sugar maple lands, mixed with some ash, and a few wild cherry and hemlock trees. In some parts of the country, the prevailing timber is still hemlock, on the sides of hills, and along streams."

"From the circumstance of the great size of all the oak trees growing in the spots noted above, it appears to me, that most of the high country, including the head waters of the Delaware, Allegheny and Chenesee rivers, was originally an oak country. The hemlock appears to have succeeded the oak, for there is still a considerable quantity of that timber over the face of the country, but from the number of logs of it lying on the ground, and its visible decline, I think the beech, sugar maple &c. succeeded the hemlock, as they are the prevailing timber at present. The timber that appears to me will take place of all others in the country before mentioned, is the white ash and wild cherry, for I observed that all places where the woods have been blown down by hurricanes for a number of years back, the young growth consists principally of those two kinds of trees, and the largest saplins of them which I saw, were six to nine inches diameter. I suppose that the appearance of the latter trees commenced between twenty and thirty years back, counting from 1794 or 1795. There are several of those wind falls, in the remote parts of Pennsylvania, and New York near the line dividing the two States; they are generally 1-8, rarely 3-4 of a mile wide, and several miles long, and in every one that I saw, and

that did not appear to have happened more than from 20 to 30 years ago, the ash and wild cherry were the prevailing timber; there were indeed other trees growing among those but from their appearance, very few of them would attain to a large size, except some birch, and I have no doubt, that if cultivating the country does not make some alteration in it, in another century, the beech, sugar maple, hemlock &c. will be as scarce in those parts of the country, where they now abound, as the oak is at present."

The benefit derived from a change of crops is so obvious, that to doubt it would argue scepticism, bordering upon the ridiculous. The same kind of seed, long continued upon the same ground, almost ceases to yield, losing as it were all excitability, or disposition to be stimulated by the qualities of the soil to which it had been so long accustomed; and yet we find that other seeds will grow in the same soil, with great luxuriance, and yield abundantly. The southern States afford a remarkable proof of this truth. In South Carolina, indigo was so long continued upon the same land, that the expence of cultivation was scarcely cleared,* and yet cotton afterwards yielded abundant and very profitable crops, upon the same ground,† and in all proba-

* Mr. Bryan Edwards says "from observing its long top, root, and spontaneous growth, in almost every dry and barren savannah, he is convinced, it will thrive on soils that are fit for *nothing else*." The difference of the experience of planters in South Carolina and Georgia, is remarkable.

† It is to be understood, that the land alluded to was not manured.

bility will be continued until the same thing happens with regard to it as to the indigo, unless the want of demand for the wool should cause it to be laid aside, before the expected event shall have taken place. It is also found, that land will yield excellent crops of cotton, which will not produce indian corn, and I have on the contrary, seen luxuriant crops of the latter growing in St. Simons, Georgia, on land which I was told had ceased to produce cotton. On tide lands too, it is found greatly to benefit ground, which exhibits signs of diminished vigour, from long cultivation in cotton, to plant rice, but in this case, the deposition from the water, when the ground is overflowed, may be supposed to produce the effect of a renewal of the soil.

J. Mease.

On Smut in Wheat. By William Young, of Brandywine, Delaware.

Read October 14th, 1806.

I herewith send a sample of wheat, which produced a considerable quantity of ears filled with smut balls, in place of grain. The seed from which it was raised was procured in this neighbourhood last October, and had been sown for four years, on the same farm, and deemed of the best quality. In the harvest of 1805 for the first time, a mixture of smut was observed. It was not however to that extent, as to be considered deeply injurious to the grain, which was of course sown upon several farms, and upon different fields in the same farm, from September to December, under various aspects, and in every situation, it produced a considerable proportion of smut balls in the harvest of the present year. I had part of two fields sown with it; the one a south, the other a north aspect. Carolina white, Virginia early, and red chaff bearded wheat were contiguous in the respective fields. There was not a ball of smut found, except that from which the sample is sent. Nor was it found on any of the other farms, except when the seed was sown from the same stock. And even the same species of wheat, procured from another farm, and sown on one of my fields, produced no smut balls.

The farinaceous part of the grain, unto which the smut adhered, was perfectly pure, after the smut was removed at the barley mill.

It is evident, that the seed produced in 1805 was infected, by a kind of hereditary disease, occasioned by

the smut, which burst from the balls, during the act of thrashing, and lodged in the small beard on the plume end of the grain, preventing or impeding the process of vegetation in the plant, in its embryo state, withholding the power required to mature the grain, at a certain period. It becomes a matter of no small import to investigate the causes of this disease, for although smut has not prevailed, in the States Pennsylvania, Delaware, and Maryland, it has been highly injurious in the remote counties of the State of New York, and in the valley of Shenandoah: and it some years ago made its appearance in a field of wheat in this neighbourhood, the seed of which was brought from New York.

If any favourite species of wheat shall be introduced amongst us infected with smut, the disease might have a rapid increase. When perhaps the evil might be ascribed to that sort of wheat, or an unfavourable state of the atmosphere, rather than to a disease inherent or attached to the seed.

The foregoing facts inform us, that smut is sometimes produced from seed, which had no mixture of it, as in the harvest of 1805. At other times it is the native offspring of the purest grain, infected with, or having smut thereon, as in the harvest of 1806. The first may arise from an unfavourable state of the atmosphere or more frequently, from some radical defect in the seed sown. When the early advances of the plants are vigorous and the infection of all sorts of wheat, at an after period, general, there is reason to presume, that the disease arises from some external circumstance, such as a hot sun, after heavy rains, continued moisture to excess in the atmosphere, while at an high temperature

high wind prevailing in a continued draught, while the bloom or farina is present, and the milk in the corn.

But when the complaint is local, unless the aspect is of an uncommon kind, there is reason to conclude the seed has been in some respect imperfect. And being unable to produce the farina, and mature the grain, an abortion takes place, and the result is the same, but not attended with all the symptoms of that sown with the smut adhering thereto. This was the case in 1805, the smut had no offensive smell, while the produce from that grain in 1806 was highly offensive, bearing a resemblance to that arising from putrid fish, and continued so, notwithstanding the low temperature of the atmosphere. This may readily be perceived by rubbing a smut ball between the finger and thumb.

The reason why the smut had no offensive smell in 1805, was, the disease seems to have progressed more slowly, and the fœtid effluvia carried off by the partial perspiration, remaining in the plant.

The introduction of smut, may be prevented by careful selection and preparation of the seed. The washings recommended by the best agricultural authorities, are to be performed, and all imperfect grain rejected; for it frequently happens, that although the principles of vegetation are not extinguished, the powers for maturing the grains are destroyed. The smut stated as having made its appearance in the harvest of 1805, seems to have originated in this way. No other farms in this neighbourhood were infected or contained any mixture of smut, except that alluded to in this paper.

The smut which made its appearance in the harvest of 1806, was evidently a species of hereditary disease,

arising from the smut adhering to the beard of the grain sown, which had fixed itself on the pure grain (after being put into motion by the operation of threshing,) where it appears deposited in the form of a fine, oily, vegetable mould.

It is as yet unknown, by what means smut becomes so pernicious to the offspring of the plant, arising from the grain to which it adheres. It does not produce any fungous matter, which might prove injurious to the root, or stalks of the plants: for their vigour and appearance were not surpassed by any in the same field. There is no apparent disease, until after the appearance of the bloom or farina, but then its progress becomes rapid and destructive. For while the plants from the uninfected grains, display vigour and health in the richness and activity of their farina, the ear at the same time assuming the texture and properties of grain, the farina of the infected is dead and pallid, adhering to the external coating of the ear, as if it were some foreign matter pasted thereon. Sterility and deadness then universally prevail, and the perspiration of the plant is at an end. The moisture which had been drawn up from the roots, becomes stagnated, and finally returns to the roots, visibly discoloured, as if it had been steeped in impoverished lye:—the stock for some time continues green, which finally terminates in yellow rust over the whole; the milk, which abounded in the ear, in place of assuming the texture, and properties of grain, becomes a putrid mass, and so far as it remains insulated, by the coatings intended for farinaceous matter and secluded from the air, it produces that offensive smell, already stated.

These are facts, which introduced themselves in the harvests 1805 and 1806; they are now produced, that every reader, may consider the plant before him, and draw such conclusions as arise out of the premises.

Another fact may be added, that some grains which tillered, you will find produced stalks with perfect ears of grain, others from the indentical grain, produced smut balls, but in no instance were grain and smut balls found in the same ear, as stated by some observers.

I shall conclude this communication, with such reflections as arise from the circumstances laid before you.

1st. That imperfect or damaged seed yields a diseased crop, and that under the circumstances last stated, the disease becomes hereditary. It is reasonable to conclude, that part of the seed sown in 1804 was damaged, for it produced a mixture of smut, while all the farms in the neighbourhood were exempted from that disease in the harvest of the next season.

2d. The disease in the harvest of 1806, from seed of the infected crop of 1805, assumed an hereditary aspect. Wherever the seed from the crop of 1805 was sown, and in those places only, smut appeared in 1806,

I am aware of the danger of submitting hypothesis, in place of facts, for consideration. It may nevertheless be proper in the present case: for as every act of the judgment is right or wrong, true or false, the hypothesis if wrong, may invite that solid information, which otherwise would have been excluded from the public eye.

It is therefore presumed, that the smut of the harvest field of 1806, arose from a privation of the action of the beard (which is on the plume end of the grain of wheat) in the œconomy of vegetation. The office of that beard, in the embryo state of the plant, is either to generate, act upon, or in the vessels producing the bloom, or farina; for if these vessels are imperfect, or the action required be wanting, all the mutual advantages which result from the perfection of the farina, and its operations will cease; instead of grain, there will be a putrid mass, as in the sample before you. Every one will allow, that the beard is formed for some important function, in the service of the plant. It is here where the cause of the disease exists; when the smut is removed from the beard, perfect grain is produced; when it is suffered to remain on the beard, smut is produced. It is then in some measure conclusive, that the diseased ears neither receive nor communicate the farina. For until this period, all the usual functions were performed, so far as inspection could determine; afterwards all the operations of the plant toward maturing the grain are at an end.

It may be objected, if the disease arose from the impaired functions of the beard, and the consequent imperfection and inactivity of the farina, that the identical grain would not, at the same time produce healthy and diseased ears, as stated. It may be answered, that upon examination of the grain with a glass, many of the beards on the identical grain, were free from the smut when sown. The office of such would therefore be performed, in the same manner, as if no disease had existed on the grain, wherein they acted. It is reason-

able to conclude, that although their intercourse with the farinaceous part of the grain, is minute, yet their ramifications are independent, as well as the leaders of the respective parts of the plant, to their proper offsets, the independence of which, has been proved, by frequently parting the offsets, and planting apart, in which cases, they matured the grain, with an increase of some hundred fold. Each member of those offsets, radically pure and perfect, although subdivided to a great extent, performed its respective function in vegetation.

The washing recommended, is merely to remove the smut and imperfect grain; whatever is found most effectual for that purpose, is deemed the most expedient. No dependance is placed on various steeps, as it is presumed, that plump seed, well kept, and laid in a soil well prepared, is the best security against smut and every disease.

Since writing the above, I have met with a case of a palm tree, somewhat analogous to the hypothesis, the palma major, foliis flabelliformibus. A tree of this kind had for 30 years, flowered and borne fruit in a garden of the Royal Academy at Berlin, but *the fruit never ripened*, and when planted did not vegetate. There was a male plant of the same kind, in a garden at Leipsic, 20 German miles from Berlin, from thence a branch of the flowers was procured, and suspended over the tree at Berlin, the experiment produced *ripe fruit*, next year it was repeated, and the palm tree produced above 2000 ripe fruit. The fruit vegetated, and produced young palm trees.—*See Hunter's Georgical Essays, York Edition, page* 432.

Remarks on the foregoing, with additional Observations on Smut, and the means of preventing it. By James Mease, M. D.

Read November 11th, 1806.

From the first fact mentioned by Mr. Young, viz. that the smutty wheat he raised, was part of a kind which had been sown for several years upon the same ground, an apparent confirmation may seem to be given to the commonly received opinion, of the necessity of a change of seed in order to prevent disease and degeneracy, but the experience of the accurate Mr. Cooper of New Jersey, and other facts on this subject, will not permit its adoption. That industrious improver has found, that the seeds of his vegetable productions improve instead of degenerating, although sown upon the same ground for various periods, viz. 20, 30, 45 years. His account being before the public,* need not be dwelt on at this time. Mr. Bakewell, the celebrated improver of the breed of cattle in England, disproved the position of the necessity of crossing breeds merely for the sake of a cross, and hence constantly bred *in and in*, from his own excellent stock, until he found one with peculiar qualities which he wished to add to those of his own stock.

The cause of smut in Mr. Young's wheat must still be sought for, but what that cause is may not be easily ascertained. The disease has prevailed to a great de-

* It is also inserted in this Volume.

gree within a few years in Britain, and has been frequently investigated by the philosophical and practical agriculturists of that country, and to their remarks I shall be indebted for what I now have to offer on the subject.

Mr. Wimpey,* is of opinion that smut is almost intirely occasioned by some vitiating principle in the air, a constant concomitant of wet, stormy weather. His experiments agree with those of Mr. Young in shewing, that grain which is vitiated by smut, infallibly causes the produce from it to be smutty: he also proves that the cleanest grains frequently produce smutty crops, notwithstanding change of seed, steeping, and liming, and adds a fact not noticed by Mr. Young, viz. that sound seed taken from smutty ears, produce as clean crops as seed from grains that were perfectly free from smut.

Mr. Somerville† thinks that smut is occasioned by a very small insect not visible by the naked eye, in the downy part of the grain. He ascertained the truth of this opinion, by observing some smutty balls perforated in many places with small round holes, and by holding them near a candle, he discovered the insects, resembling wood lice in shape. The heat from the concentrated rays of the sun thrown upon the balls with a burning glass, also put them in motion, and shewed them in every different point of view. He supposes that when the balls are broken in the operation of threshing, or come in contact with clean healthy grains, the insects

* Transactions of Bath Society of Agriculture.

† Communications to Board of Agriculture. Vol. 2.

leave the smutted grains, and adhering to such as are healthy, are sown with them, and wound the tender stem in such a manner as to render the plant incapable of producing any thing but smut. Another practical writer* also ascribes the disease to an insect, which lays its eggs in the downy parts or beard of the grain, and by wounding the ear in several places, checks its growth.

The late Sir John Call,† entertained the same opinion as to the cause of smut, but he adduces no experiments to support it. He adds however a fact, which is contrary to the experience of Mr. Wimpey, Mr. Young, Mr. Somerville, and all others whose observations have been published: it is, that the black dust of the smutty grains has no effect upon the growth of sound grains, though rubbed and mixed therewith. The Rector of the parish, and two farmers, have certified to the correctness of his statement. Giving full credit to the fact, we can only say, that being so contrary to general observation, prudence requires that we do not follow a practice attended by mischief in all cases except one.

Baron Munkhausen of Hanover,‡ also says, that after a strict examination of the black powder of smut, with a microscope, he found it to consist of small transparent globules, with black specks in the middle of each: that these globules are the eggs of extremely minute insects; from these eggs, when they are placed in water of a certain degree of warmth, there proceeds, an animalcule of an egg shaped form. When the wheat is

* Communications to Board of Agriculture. Vol. 2.

† Same work and Volume.

‡ Gentlemen's Magazine. 1768. p. 698.

threshed, these eggs stick to the tops of the sound grains, which being sown, continue the evil.

Mr. Caleb Kirk, who lives near Mr. Young, sent me a specimen with the smut attached to the grains, in consequence of the diseased sheafs having been threshed among the sound, in which order it came to his mill to be ground. He first passed it through the barley mill,* and thereby removed the smut, (which chiefly adheres to the downy substance at the upper end of the grain,) and then found that it produced excellent flour; whereas when ground without this operation, a flour was produced of a dark colour, which, though it rose well, yet spread out when baken, into the form of a cake, and became compact; and when cold was dry and crumbly, and so hard, that a knife entered with difficulty; it was moreover without the agreeable taste of bread.—Four bushels of infected grain yielded half a bushel of smut!

From a paper in a French periodical work on domestic and rural œconomy,† it appears, that by washing and drying, smutty grain may be rendered fit for mill, and for making wholesome bread, but to do this properly, the wheat must be stirred with a broom, and rubbed with the hands, in small quantities at a time; the foul water must be let out of the cistern, and fresh water put upon the wheat, until it runs off clear. If it is washed at a river or a well, the basket must be plunged in several times quickly, that the grain may be

* Mr. Kirk makes pearl barley equal to any imported, and cheaper.

† Bibliotheque Phisico—Economique.

washed without being softened, to prevent the difficulty in drying it, and to avoid wrinkling the skin.

From an accurate analysis of the smut of wheat, by those eminent chemists, Vauquelin and Foucroy,* it appears, that it is only a "residuum of putrefied farina, which instead of the constituent elements of this last, viz. starch, gluten, and saccharine matter, contains only a kind of charred oily substance, very similar to that species of bitumen which derives its origin from animal or vegeto-animal bodies.

For seed grain, Mr. Young places no dependence upon steeps in preventing smut in the succeeding crop, but there are several facts on record, which would lead us to incline strongly to the belief, that some have a powerful influence; a few of these shall now be mentioned.

1. Tull, the father of the drill husbandry relates, that a ship load of wheat was sunk near Bristol, in autumn, and afterwards, at ebbs, all taken up; but being unfit for the miller, it was used for seed. At the following harvest, all the wheat in England was smutty, except the produce of this brined seed.

2. Mr. Richard P. Barton of Frederick county Virginia, relates that in 1805, some fine wheat was brought from Redstone Pennsylvania, to his neighbourhood to exchange for salt; and having purchased two bushels, he steeped it in strong salt brine, and then sifted on it as much quicklime as would adhere to it. Two of his neighbours sowed some of the same wheat without steeping. The soil was the same, and the seeding done in

* Annales du Museum d'Histoire Naturelle, No. 35.

good order, and in good time. Mr. Barton's crop was free from smut, at the following harvest, but the crops of the other two persons were much infected.*

Mr. Somerville in the paper before quoted upon blight, smut and mildew in wheat, says that from his own observation, aided by the testimony of the most respectable farmers, the salt pickle has always prevented the crop from suffering by smut, where it has been judiciously applied, yet that under certain circumstances, it may be injurious.

3. In the Farmer's Magazine,† we find the following remarks, under the Banffshire quarterly agricultural report: "what wheat we have, where free of smut, is of excellent quality. The advantage of pickling was apparent in a patch, where part had been pickled, and part of it not. The former was very little touched, while the latter was at least a fifth or sixth smutted. Several instances of this kind shew the utility of that preparation, and though it may not at all times be an entire preventive, it should not be omitted."

A writer in the same volume:‡ who signs J. W. and dates from Norfolk, offers for a trifling premium per acre, to insure the whole seed of England from injury by pickling, and the crop from being damaged by smut, provided the following recipe be judiciously applied.

"Steep your wheat five or six hours in water brought from the sea, or in common water salted, till it is strong

* Barton's Medical and Physical Journal. 2 Supplement.

† Vol. 5. page 483, printed at Edinburg. An excellent work, which ought to be in the possession of every farmer.

‡ Page 443.

enough to swim an egg, stirring it frequently. Procure first unslacked lime, and when you begin to let the water off, slack your lime with a small quantity of it; when the water is completely drained off, turn the wheat out of your tub, and to every bushel of it allow a peck of lime; sprinkle this over it, and stir the whole with a shovel till they are completely mixed, so as every grain may receive a share. When dry it is ready for sowing, but should the lime prove troublesome or dangerous to the seedsman's eyes, some more water may be thrown upon it, for when the lime is dry, the cure is effected. If the wheat is meant to be drilled, sift the lime upon it, in the first instance, and from it, afterwards.

"The lime, I am persuaded, is the grand panacea, and I only recommend salt water in preference to fresh, because the lime adheres more closely to the grain, when the former is used. The principal difficulty in the process lies in the mixing of the wheat and lime completely, so as every kernel of the wheat may receive its due proportion of lime; for unless this is carefully attended to, danger will not be prevented; every kernel that escapes the lime, being liable to receive and propagate the disease. I once witnessed a case, which has fixed me most firmly in the opinion, that fresh lime is absolutely necessary to accomplish a cure. A very experienced and intelligent farmer having used all the wheat he had prepared for seed, wanted a few bushels to complete his sowing; and being at a considerable distance from the kiln, determined to make use of some old lime, which had been long in his possession. I examined the crop along with the owner, in the succeeding

year, when it was ready for the sickle, and found, that where hot lime had been used, no smut prevailed, but that the crop was much hurt where cold lime had been substituted.

"Some caution is certainly necessary with regard to lime; for should it be used when not properly slacked, the great degree of heat thereby occasioned, would destroy the vegetative principle of the seed; but if applied with the precautions recommended, I am persuaded that the liming and pickling may, in some slight degree act as a manure. I have practised the method of pickling now described, for more than twenty years, and never suffered injury from smut. Once, and once only in that time, during my absence from home, and when my regular seedsman was indisposed, the process was left to an inexperienced hand, and I was a material sufferer, by his applying the lime without slacking it sufficiently."

The authority upon which the above observations and facts are given, is certainly lessened from the circumstance of its being anonymous; and yet they are in part corroborated by so many living persons, that we suffer no risque in admitting them in favour of the practice under consideration. It must however be remarked, that the opinion entertained respecting the lime being the chief agent in the prevention of the disease, is certainly not supported by as many, as that which attributes an equal share to the salt water.* I myself was

* Mr. Somerville, as we have seen before, thinks that the lime is useful only to dry up the superfluous moisture and make the grains separate and sow more readily; chalk or

shewn two years since, by Job Roberts of Montgomery county, Pennsylvania: a fine field of wheat, which fully proved the utility of steeping the seed in simple salt and water. For the sake of experiment he sowed a strip in the middle of the field, with dry unsteeped seed and the backwardness and want of vigour in that portion, when compared with the rest of the field was so apparent, as to call forth a remark from me. He informed me, that several of his neighbours had tried the same steep, and were so convinced of its utility, as to induce them to continue the practice.†

These facts are sufficient in my opinion, to prove the benefit derived from steeping seed grain in various liquids: some caution however is to be observed in the process; according to Mr. Somerville, "while the grain steeped in the pickle continues in a moist state, it may be kept for any length of time without much injury, but wheat which has undergone this preparation, and has had lime in a very active state mixed with it, if sown early in autumn upon warm dry land, and no rain falls for a considerable time, a great proportion of the grain will be either entirely destroyed, or materially injured."

Mr. Wagstaffe found that soaking and rinsing the grain in simple water, was effectual in the prevention of

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whiting will therefore he thinks answer equally well, without the risk attendant upon the use of lime.

† Stale Urine is sometimes employed as a pickle for seed grain, but it requires so many circumstances to concur in order to its being used with safety, that it should be avoided upon all occasions.

smut from the succeeding crop; this plan may therefore be tried, where the salt pickle cannot be used with safety.—*Bath Society Transactions.*

Cause of Increase of Insects in Grain.

Mr. Somerville acknowledges that experience has decided, that particular seasons are more favourable to insects than others: yet supposes that they are propagated chiefly by the chaff, in which they commonly lay their eggs, being mixed with the barn yard manure; in proof of this he says, that in all cases where any material injury has been done to them, it is to crops that have been well manured. And further, that if the sweepings of a barn, in which smutty wheat has been thrashed or mixed with dung, be laid upon land where wheat is to be sown, the crop will infallibly be tainted with the disease. Trials of this have been made, and in some instances four fifths of the plants sown, where the dung so mixed was laid, produced nothing but smut balls.

The radical means of preventing the propagation of the insect, according to Mr. Somerville, are 1st. to collect and burn all the chaff and dust; 2d. By applying the manure in the spring instead of the autumn, on the surface: and also 3d. By mixing lime with the manure, after it has completely fermented, by which the insects will not only be destroyed, but putrefaction in the dung promoted, and its effects upon the dung, rendered more valuable.—Other substances possessing similar properties as lime may be used for the same purpose, but

under the above restriction, as soapers (leached) ashes, bleachers ashes, or refuse, potash, kelp &c. all of which destroy insects, and render the dung more valuable.

Remarks on the Smut and Mildew of Wheat; with hints on the most probable means of prevention.

By A. Fothergill, M. D. F. R. S. *&c. &c.*

Fiat Experimentum.—BACON.

Read November 11th, 1806.

The Society at our last meeting, having requested my opinion on the nature of the disease, I must observe that the subject appears hitherto to be too little understood to admit of a clear and satisfactory elucidation. Such useful hints however, as occur to my recollection, I will now lay before the Society without reserve.

This and almost every disease, however different in its nature, which renders fruit or grain unproductive has been called a blight—a generic term of indefinite signification which writers on husbandry have adopted, without proper discrimination: thus the smut, the mildew or rust, the effects of lightning, of sudden changes of weather, and the depredations of insects have all passed indiscriminately under the general, though vague appellation of blights. Writers have, however, liberally furnished us with sundry infallible remedies so called against blights in general, and particularly against smut, but these infallibles, when put to the test, have generally had the misfortune to fail.

The smut of grain is easily distinguished by the black dust which covers the ear, seemingly as if sprinkled with soot; whereas the mildew or rust infests the stem and leaves with yellow and dark brown stains, and forms an orange coloured dust, which viewed with a good

microscope, is found to consist of clusters of a fungus or parasitical plant, the invisible seeds of which insinuate themselves into the pores of the absorbent vessels of the stem, and deprive the grain of the sap destined for its nourishment.* Of this minute fungus, highly magnified, Sir Joseph Banks has given beautiful plates finely executed by Bauer, engraver to his Majesty.

In some parts of England, where I have had opportunities of observing the disease called smut, it has never been so general as described by some writers, but partial, consisting of some solitary black ears, dispersed here and there, among an infinite number of others, sound and healthy. On viewing more narrowly the smutty ears, some grains have been sound, while others have been reduced to chaff, others, small and shrivelled.

By washing the infected grain with water in a cylindrical vessel adapted to the purpose, (to which is given a rapid circular motion) they may be wholly divested of the smut,† and much useful grain preserved, which being afterwards gently dried in a kiln, and a part of it used as seed, an experienced farmer assured me produced a moderate crop, and perfectly free from smut. Having seldom seen the disease among long bearded grain, as rye, or barley, I am inclined to think it is most predominant in wheat, especially the smooth eared sort, and in late harvests, particularly in Great Britain; nor

* Communications to the Board of Agriculture, Vol. 4. page 399.

† When the smut is so glutinous as not to be thus washed off, I should recommend the addition of an equal quantity of fine sand, in order to cleanse the grain more effectually.

do I recollect, in those samples I have seen, that the black powder emitted any offensive odour; though in warm, moist seasons, when a higher temperature disposes more powerfully to putrescency, the disease may become more general, and assume a more putrid or virulent nature.

Like the mildew, it is most prevalent in low grounds and in a damp or foggy season, but never produces such extensive damage as the mildew which infests whole fields of grain and grasses. For the destructive effects of the mildew have frequently been experienced not only in the United States, and the British isles, but also in Germany, France, Italy, Sicily, and even in New South Wales, though its cause has never yet been clearly developed. It has long been a received notion, that wheat cannot thrive near the barberry bush, and as that plant has a yellow flower, and has been found liable to the mildew, it has been accused of first propagating the disease to the wheat. But the disease infests the grain where the barberry shrub is unknown, and wheat has been sown under the shade of the barberry without being injured. This experiment is said to have been carefully performed a few years ago by a farmer near Edinburgh, and considered as decisive.* However, before we undertake to exculpate the barberry tree from the general odium under which it has long suffered, it will be very proper to repeat the experiment in different climates, and under different aspects. The noxious quality imputed to the barberry tree has already indeed caused the plant, in many places, to be to-

* Edinburgh Farmers Magazine, No. 10.

tally extirpated. Should this popular opinion, like many ancient prejudices, be found to belong to the catalogue of vulgar errors, the sooner it is detected the better.

But to proceed,—Mr. William Young, in his paper, read at our last meeting, well describes the progress of the disease called smut, at Rockland and the neighbourhood, in Delaware State, where the damage occasioned by it, appears to have been very considerable.

The seed had been used four years successively, and where it had afterwards been sown, there the disease appeared, and no where else. He attributes it, with many other writers, to imperfect or infected seed, and concludes that it seems to be a hereditary disease: this at the first view, seems at least somewhat plausible, as a disease may be hereditary (as we often see in the animal kingdom) without affecting all the offspring of the diseased parent; but can we believe that any washing can remove an hereditary taint? The smut indeed has been considered by many writers as very infectious, yet how can we reconcile this with the experience of others who have raised sound ears from smutty seed, as has been hinted, or with the fact of a smutty ear being surrounded by various sound ones, without communicating the disease? It were to be wished, however, that the principal cultivators of wheat would pursue Mr. Young's laudable example, in making accurate observations on the rise and progress of the disease, and the different methods of treatment.

Analysis of the Smut.

A foreigner, M. Chantran, on analysing the smut, found it yielded an acid to boiling water, which reden-

ed turnsole. It emitted the odour of burnt grain by calcination, and left 6 times the usual residuum.—On the whole, he concludes it to be of an animal nature. Had it yielded phosphoric acid, and azotic gas (of which we have no mention) it would have afforded a stronger presumption, though still not a proof of his conclusion. Besides, that singular principle peculiar to wheat, the gluten partakes of the animal nature and yields similar products. Therefore, whether the smut be of an animal or vegetable nature still remains doubtful, and requires several experiments to unfold its real origin, which notwithstanding the experience of many centuries, in which the disease has been in existence, its cause seems still to be entirely unknown.

I shall suggest to the Society a few experiments, the result of which possibly might afford some new light on this subject.

Experiment 1. Let a considerable quantity of the smut be collected in a separate state, and a part of it subjected to calcination and distillation in close vessels; and let all the volatile as well as the fixed parts, be minutely examined by chemical tests.

Exp. 2. Let a portion of the smut be viewed, when placed in the focus of a powerful magnifying glass.

Exp. 3. Let another portion be kept in a phial half full of water covered with gause to admit air, and exclude insects; and another be sown in a pot of fine mould to try if it will either hatch latent ova, or vegetate. But upon reconsideration,—parasitical plants are never observed to take root in the earth, as for instance the misseltoe, yet the viscid juice of its berries when ripe, if rubbed on the smooth bark of almost any tree,

will produce misseltoe the following season. Therefore instead of placing the smut in mould, it may be more adviseable to introduce it into various parts of a plant of wheat, as the stem, and the ear in various stages of vegetation, from the milky state of the grain to its complete maturity.

The first experiment may serve to shew whether the products yield azotic phosphoric or carbonic gas; or a fixed or a volatile alkali, and consequently whether they partake most of the animal or vegetable nature: finally the products should be compared with those of sound wheat.

The second may shew whether it contains any visible marks of organization, as the seeds of vegetables or the ova of insects.

The third whether any of the particles can be made to bring forth insects in the embryo state, or clusters of minute fungi, as in the mildew, which are visible in a very good microscope.

The black powder of the puff ball, which bears no small resemblance to the smut of wheat, contains the invisible seeds of the plant, which are buoyant in air, and float in the atmosphere till they descend to the earth with rain or dew, to be deposited in the soil. The seeds of the parasitical fungus, which insinuate themselves into the pores of the stem or leaves constituting the mildew, are alike invisible to the naked eye, and are probably disseminated in the same way, as are also the other minute seeds of the fungi, which belong to the *cryptogamia* of Linnæus. The mildew commonly exhibts a yellow powder, but Sir Joseph Banks observes another species which consists of a dark brown or chocolate co-

loured powder; who knows but a third species of fungus may produce the black powder, which constitutes the smut? And the mushroom tribe be found more injurious to grain than has yet been imagined?

The time of blooming is the critical period at which the smut first begins to shew itself, and then proceeds rapidly, as Mr. Young observes, converting part of the ear into chaff, or preventing the grain coming to maturity. For whatever may be the hidden source of the smut, the proximate cause of scanty crops of grain, frequently consists in an imperfect impregnation at the time of flowering. For according to the impregnation, the grain will be either plump, shrivelled, or entirely abortive. Heavy rains with high winds, at this season, by washing off a part or the whole of the pollen, destined for fecundation, generally cause a scarcity in the ensuing crops. If the pollen be consumed or vitiated by insects or fungi, a proportionable failure will take place. On the other hand, a calm, dry flowering season is favourable towards a full and perfect impregnation. Hence, when the spring proves dry, and wells and rivulets sink to a low ebb, the British wheat harvest is generally abundant. Here permit me to propose another experiment.

Exp. 4. Let a portion of smut be sprinkled on the centre of the flower, and let the same be performed on rye, barley, oats and other grain in the blooming season, to determine whether the disease can be propagated by inoculation. If the wheat should acquire the smut, it proves the contagious nature of the disease, if all the other kinds of grain should resist it, it will confirm the opinion of its being more incidental to wheat; accord-

ingly we are informed by Mr. Bordley,* that an intelligent farmer in Georgia, protects his wheat from smut by mixing rye with the seed, or encircling it with a list of rye, of 25 feet breadth, which he considers as perfect security, and adds, that it has also been tried with success in England. This however, merits further investigation in other places, and in different seasons. For if rye itself, be liable to the disease, how can it protect other grain?

Prevention.

Various means of prevention have been proposed by steeping the seed in different antidotes, and sanguine expectations formed of their success from the extravagant encomiums of their authors, such as acids, alkalies. neutral salts, lime, brine, sulphur, &c. But the fresh soil, with its exhaling moisture, soon destroys the most offensive tastes and odours; assimilates foreign substances, and speedily overpowers the virtues of these pretended antidotes. Accordingly most of them, after many fruitless trials, have at length been given up, some as useless, others as highly pernicious. Therefore the best precautions I can venture to offer at present, are the following. For until the nature of the disease be more fully ascertained, it is not easy to direct the proper remedy.

1. Make choice of the best seed wheat that can be procured, and particularly such as comes soonest to maturity, as the early Virginia, or the red bearded wheat.

* Notes on Farming, page 481.

Prime seed thus selected, need not ever to be changed, nor will it degenerate under proper culture, notwithstanding what some writers have asserted to the contrary. This curious fact has been confirmed by more than thirty years practice, by Mr. Joseph Cooper, an eminent farmer in New Jersey. As the most perfect seeds of vegetables sink in water—this may be a criterion of good wheat, proper to be selected for seed, and such grains as float on the surface should be rejected. Nevertheless some eminent authors allege from experiments, that the small shrivelled grain, or refuse of fine wheat after winnowing, if not deprived of the power of vegetation, yields an equal, or even superior produce at the harvest, because a bushel of the shrivelled seed contains 3 grains to 2 of the plump grain. Hence by using an inferior sort for seed, and converting the best kind of wheat into flour, a great annual saving may be made.* But this is a species of œconomy so directly contrary to the practice of Mr. Cooper, and other eminent farmers, who improve their grain by a careful selection of choice seed, that a contrary method, it is presumed, will not be readily adopted, unless in a season of extreme scarcity.

The immersion of seed wheat in water, and then gently drying it just before sowing, will accelerate germination, in a more kindly and natural way, than the artificial stimulating steeps commonly employed.

2. Where wheat cannot be readily had, without a mix- of shrivelled or imperfect seeds, the above method will

* Communications to the Board of Agriculture. London. Vol. 2. p. 630.

bring it to the test—and as it may be used with safety and advantage at all times, it ought never to be neglected in mixed grain, or imperfect samples.

3. If the seed wheat be suspected of having received a taint from smut, rust, or the ova of insects, particularly the wheat moth, (not the Hessian fly, improperly so termed) which first committed its ravages in Virginia, and afterwards extended its depredations to the neighbouring States, we know no means of prevention, more likely to produce the desired effect, than the exposure of the seed to such a degree of heat, or cold, as will destroy the life of insects, without being incompatible with the germinating power of the grain.*

Exp. 5. The proper degree of heat requisite to accomplish both purposes, will probably be found between 150 and 180 of Fahrenheit's thermometer, and might easily be determined by subjecting the suspected grain to the heat of a maltster's kiln, carefully regulated to the necessary temperature, previously ascertained by accurate experiments: The malting heat probably sometimes exceeds 180°.

Exp. 6. As wheat can sustain without injury, a much greater degree of cold than is necessary to kill insects, and perhaps also their ova, in an unsheltered state, let the suspected grain be spread out on a sail cloth, to the open air, during two or three sharp frosty nights, and let the grain, after undergoing these processes be sown, noting the germination and produce, compared with those of

* See the valuable Notes on Virginia by his Excellency the President of the United States, whose opinion here coincides with that, which we wish to establish.

other healthy grain in a similar soil. Happily for mankind, wheat is accommodated to almost every climate, and by habit, is enabled to sustain the scorching heat of the torrid zone, or the extreme cold of high northern latitudes sufficient to freeze mercury, though it certainly thrives best in the more temperate regions. Should these experiments, after repeated trials, prove successful, the result, being communicated to the Society, might prove highly important towards that great *desideratum*, the preservation of grain from the deplorable depredations of the moth, the weevil, and other destructive insects. Notwithstanding the means hitherto employed, have generally disappointed expectation, yet the case ought, by no means, to be given up in despair, as totally irremediable: This would only render it such, by checking all further enquiry. Since there are few evils, for which nature has not provided some remedy, it becomes the duty of the philosophical agriculturist, in the present case, to trace her footsteps through her hidden recesses, by prosecuting his researches with redoubled ardor.

"*Mille mali mores, mille salutis erunt.*"

Since writing the above, having met with the following interesting passage, from the Transactions of the Linnæan Society in London, we flatter ourselves gentlemen will readily indulge us a few minutes longer, in reciting it; as it tends to corroborate what has been already advanced.

The Rev. Mr. Kirby, F. L. S. has noticed certain species of this minute parasitical mushroom, which are supposed to occasion several species of blight found on various kinds of grain, and grass.

The first is our *recticularia segetum*, or smut, and which in England, is called dust brand, smut, or burnt corn, a species common to wheat, oats, barley, and rye; is scentless, and consumes not only the farinaceous part of the grain, but even the chaff.

The second is called *pepper brand*, or *bladders;* this species consumes only the farinaceous part of the grain, which assumes a deep and dingy hue, and, being crumbled, emits a very fœtid scent, like putrid fish, which distinguishes it from the former; it is considered as very prejudicial to the farmer.

The third is that known to agriculturists by the name of *red gum (æcidum,)* which throws forth a powder of a bright orange colour—this minute mushroom does not appear to be so materially injurious to the grain.

The fourth is very common on wheat, the *uredo frumenti*, (Sowerby 140) grows on the ears, straw, and chaff, bursting in longitudinal streaks from under the epidermis, or skin; this is represented as the blight of the wheat, and which in certain soils and seasons, is so very injurious to that grain.*

The fifth is the one, by which the wheat, in certain parts of England, in the year 1797, suffered very considerably, which the farmers call *blight or mildew*, and by far the worst enemy to wheat; the ears injured by it, were distinguished at a considerable distance, by their blackness, and on closer examination, they appeared as if soot or some smutty powder had been thrown upon them; the chaff appeared covered with small black dots, very different in appearance from the *uredo frumenti*, on the

* Sowerby on British fungi. Vol. 2. Table 139 and 140.

same plant; he observes that wheat seized with mildew, is only fit food for swine or poultry; and that on examining a mildewed ear with a lens, the appearances did not so fully convince him of its being a fungus, as the other species did; however he seems inclined to believe it is one, because Abbe Tessier, who had expressly written on the subject, asserts, that the mildew is a very minute lycoperdon, or puff ball, and Sir J. Banks who has lately seen clusters of a mushroom plant on mildewed grain, seems to confirm the opinion.

Upon the whole then, it would appear that the blight, or mildew is the most destructive species of *recticularia frumenti;* and Mr. Kirby very justly laments, that some method has not yet been found out, to prevent this blight, as effectually as that, which has long been in use amongst farmers, to secure their crops from the smut, —meaning slacked lime.

There is yet another species of blight, entirely distinct from any of the preceding maladies, mentioned by Mr. Kirby, namely that which proceeds from the numerous race of *Aphides*, which cause great ravages among fruit trees, and are now known to produce the honey dew, often visible on the leaves of trees, in a warm season; but this is too remote from our present subject, and would merit a separate discussion.

Mr. Kirby proceeds to enumerate sundry steeps for seed grain, as alkaline lixivia, common salt, vegetable and mineral acids &c. and concludes that slacked lime is the most efficacious, but acknowledges that lime is dangerous, especially when slacked in the air, and that a farmer by using it, sustained a loss of 300 pounds sterling.—Here it may be doubted whether the remedy was

not worse than the disease.—From the result of many experiments, he also owns, that wheat washed with simple water, produced the greatest number of plants; and that with acid steeps, the smallest number. He concludes with recommending the washing it with water, and drying it with slacked lime. He makes no mention of nitre (salt petre) yet as this, by a singular accident, has been discovered to be an effectual preventive of the depredations committed by weevils, and may be used with safety, we should incline to try it, in preference to all the other artificial steeps. Likewise gentle kiln drying, carefully regulated, as already hinted; or exposure to a keen frost, as safer, and better than the method proposed by Mr. Kirby, with slacked lime. It may be proper, however, to try the difference between lime, slacked in water, and in air. In case of mildew, or wheat moth where the very straw is infected, and probably swarms with minute parasitical seeds, or ova of the moth, or other destructive insects, the grain should be speedily thrashed out, and may probably be secured by the above method, which we have earnestly recommended: still, however, as the straw may afford a *nidus* for a future progeny; it should therefore, be dispatched from the barn, as quickly as possible, to form compost, and during the putrefactive process, well incorporated with quick lime; the chaff and sweepings of the barn, and the stubbles ought to be burnt upon the ground, which may enrich not only the soil, but tend to extirpate the evil; towards which important purpose, all farmers ought cordially to unite, otherwise a single neglect of the means proposed, may renew the calamity, and propagate it to the adjacent farms.

Finally, should future researches confirm this opinion (however novel or fanciful it may at present appear) that the 5 species of blight above mentioned, result from one genus of parasitical fungus, it would seem to follow, as plants of the same genus partake of similar qualities, according to the law of nature, which produces similar effects from similar causes, that an effectual remedy against one of these species would be applicable to all the rest, agreeably to the simple means we have proposed, and which seem to merit a fair trial.

But while thousands of parasitical seeds are probably floating, unseen around us, we can only act on the defensive, in preventing, as far as we are able, their fastening on our seed wheat, by destroying the vegetating power of their invisible germs, without injuring the grain. As a further security against moths and weevils, the sacks, in which the wheat is kept, should be previously impregnated with a solution of nitre, fumes of sulphur, or of charcoal. This would afford a very proper subject for an experiment, in addition to those, which have been proposed.

Exp. 7. Let the preservative effects of these methods on grain, exposed to a long voyage, be compared with an equal quantity sent out, in the same vessel, in the ordinary way, which would bring the matter to the test.

Exp. 8. Lastly, to determine whether, as some eminent authors allege, the shrivelled seeds of smutty and mildewed grain can yield as good a crop as plump sound seed: let some of each sort be sown at a distance from one another, and from other crops, and the result carefully noted. If the products resemble the parent seeds in quality, or in other words, good grain from good

seed, and *vice versa*, it will confirm the general opinion, of the importance of selecting choice wheat for seed, agreeably to the judgment of the most eminent farmers. If so; it will next be worthy of their inquiry, whether the frequency of smut, and mildew, may not be generally traced, in the first instance, to vitiated or imperfect seed, or that which ripens late in the season; the vegetative principle of which, being feeble, predisposes the wheat to these diseases; while early, sound and healthy seeds vegetate vigorously, and resist intruding insects, and parasitical germs, till the critical period be past; after which they are secure.

Whence is it, that the white efflorescence called mouldiness, overspreads the surface of dead plants, while all the living ones, contiguous to them, wholly escape? Is it not the vegetative, or vital principle which protects the latter? and the loss of it, which exposes the the former to decay, and to fall a prey to the enemy?* But the disease, called mouldiness, if narrowly examined, will, it is presumed be found nearly akin to mildew, and perhaps turn out to be, only another species of mushroom, belonging to the parasitical family of plants.

* Crops of grain in a moist state, or containing (as often happens) a mixture of weeds, when smothered close in a barn, and deprived of proper ventilation, soon exceed the point of healthy fermentation, and contract not only, the disease of mouldiness, but are peculiarly incident to depredations from mildew, moth, and vermin. Might not ricks of grain, well secured, in the open air, in this, as in other countries, supercede the use of large expensive barns, and at the same time, preserve the grain more completely, from these destructive incidents?

But this, being at present, a matter of conjecture only, is submitted to the future observation of the inquisitive naturalist, possessed of a penetrating eye, and powerful microscope.

If the preceding new doctrine be true, it will tend to correct some received opinions, and prove that many of the diseases termed blights, hitherto attributed to other causes, will, on a more close inspection, be found to originate from a parasitical vegetation, or the depredation of insects; either of which causes may probably operate, by depriving the grain of its nutritious sap.

POSTSCRIPT.

In a late elaborate essay, which we have just had the pleasure of perusing, the author Mr. Robert Somerville endeavours to prove, that the smut originates from a very minute insect, which he detected in the smut ball by the microscope, but not till it was put in motion by the heat of a candle.* That it appeared red, and resembled a boiled lobster, and afterwards turned black and was covered with a crustaceous coat, in which state it remained till it died.—That the dark coloured stains, on the stems of wheat are produced by its excrement. That it wounds the tender stem, at the place of the insertion of the grain; preys on the milky juice, and deprives the ear of nourishment. That the smut balls consist of fine vegetable earth, which the diseased plant

* Communications to the Board of Agriculture. Vol. 2. p. 214.

absorbs from the soil, and transmits to the ear. That the insect is generated in stable dung, and abounds most, where fields are most plentifully manured. That its ravages are confined to the tender blade, in the flowering state of the plant, and never take place afterwards. That potatoe plants and clover are infested by similar insects, bred in the manure. That the insect is well known to farmers, and has been long observed, even in their best fields of wheat. When a diseased plant is pulled up, one or more worms are found at the root. Whether the insect is at length transformed into a fly, is not mentioned. He thinks wheat, in the growing state, may be protected from these insects by a weak decoction of aloes, tobacco, and hellebore: a long double flannel being steeped in it, is drawn over the whole ridge, and back again, so as to touch all the plants, on both sides.

Having thus briefly stated the result of his researches, we shall conclude with a few remarks.—Should his observations be confirmed by future enquiries, it would seem, that the smut is rather to be considered as a vermicular, than a parasitical disease; but as worms in the vegetable, as well as in the animal system, are often the effect, rather than the cause of the disease attributed to them, it will become agriculturists to examine, whether worms are essential to the production of smut, or only an adventitious circumstance, in certain seasons, as in late crops, and a feeble state of vegetation. Hence the necessity of such further observations, as may sufficiently clear up these difficulties. For instance,

1. Whether worms are not often found, at the roots of healthy grain?

2. Whether the smut ball consists of vegetable earth, as Mr. Somerville supposes, or whether it is not rather the milky substance of the infant grain, carbonized by the heat of the sun, and converted into a kind of charcoal?

3. Whether sound wheat, on which no stable manure had been applied, be wholly exempt from the smut?

4. As stable manure tends to infest green crops with insects and weeds, whether it may not be divested of that property, by undergoing a previous putrefactive fermentation, and afterwards, by being incorporated into a compost, with an equal portion of quick lime, as has been mentioned?

Should smut be found, where no vestige of worms or insects can be discovered by a powerful microscope; or mildew, without any trace of parasitical fungus, it will afford reason to suspect, that these supposed causes of the respective diseases, were rather the effects, or only adventitious circumstances, and that a more close scrutiny will still be necessary, to afford complete satisfaction to philosophers. For instances of mildew have been noticed, where no stable manure had been used.*

As the proposed methods of prevention are applicable to both maladies, it now will rest with agriculturists to determine the points in question, by attentive observation and accurate experiments, agreeably to what has been suggested. For whatever may be the result, *truth* ought to be the *principal object* of our researches.

* Board of Agriculture. Vol. 4. p. 399.

Having conducted this essay, solely with that view, and directed the scattered rays of light on the principal objects of inquiry, the prosecution of the subject, it is presumed, will now, be rendered more easy to experimental agriculturists. But since microscopical insects and parasitical germs, in their infant state, are invisible to the naked eye, and the diseases, apparently produced by them, seldom discovered till the mischief be done, farmers ought to be extremely vigilant, in the timely application of the most rational means of prevention: Whether they adopt the present plan, or any other course of experiments, they are requested to favour the Society annually, with the result of their observations.

If the preceding pages should put them on their guard against drawing hasty conclusions, from fallacious appearances, and facilitate the experimental inquiry proposed, on a subject so interesting to the country, the author will think his labour has been well bestowed.

Substitute for Trench Ploughing, and new Mode of putting in Winter Grain, and on live Fences. By Caleb Kirk, near York, Pennsylvania.

Read Nov'r. 11th and Dec'r. 9th, 1806.

I observe in the United States Gazette, sundry premiums offered for improvements in agriculture; among which the 2nd and 7th subjects, viz. Trench ploughing, and live fences, have engaged my attention for a number of years. As to trench ploughing, I am fully of the opinion that 12 inches is a depth, too great to bury a scanty soil, except the farmer, has a great store of manure to dress his field after ploughing. Moreover as few farmers have six able work horses or oxen, the paring and trench ploughs, which are directed by the society to be in action at the same time, cannot be employed; besides, I know from my own experience, during seven years, that equal benefit may be derived from the adoption of another mode of working land, as from trench ploughing, without requiring more than half the number of horses.

In the first place, coulter the ground with a coulter plough drawn by two horses, about eight or ten inches deep, the cuts being about one foot apart: then plough the land in an opposite direction, with a common bar share plough with two horses to about the same depth, and let a man follow in the furrow with a narrow spade plough, three inches broad and drawn by one horse, to break the under stratum four or six inches deep. Thus the surface is turned eight or ten inches deep, and the

ground effectually loosened from 12 to 16 inches deep. This practice I esteem more advantageous, than that of burying the old soil to the same depth by trench ploughing, does not require more than three horses, and may be adopted in any soil however dry, provided it is not too stony or stumpy. It has been particularly practised by me for the last seven years, when the ground is hard and dry in summer, or the sward very tough.

For wheat, I prepare my ground as if it were to be seeded in the common way (with a bar share plough;) the ground being harrowed smooth, it is then ploughed with the shovel plough, the shovel of which is 15 inches long, and about 13 inches broad at top, rounding off to an obtuse point. With this I make about ten cuts in the breadth of a rod, not ploughing it in lands, but going along one side of the field, with one horse in the furrow, and returning on the same side of the land or field, with the off horse in the furrow, thus forming one ridge: then going with the near horse in the last made furrow, another ridge is formed, and so on till the field is ploughed. Thus every ridge or row will go from end to end of the field, which will seldom be the case, if the field be marked out in lands, and then ploughed by going on one edge of the land, and returning on the other, as there is often some small difference in the width of the land, near the finishing, which might make two furrows run into one, and not be so plain a guide to the reapers: and as the shovel plough throws the mould on both sides alike, the ridges will be as fair one way, as the other.

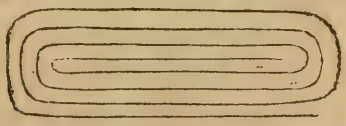
The cuts or furrows will appear about six or eight inches deep, with a sharp ridge between them. I then

sow broad cast, and harrow in the direction of the furrows.*

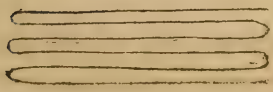
Grain sown in this manner has many advantages. The plants stand handsomely in rows, which are a sufficient guide for the reapers, and for sowing clover seed, or gypsum; and the whole field being in one entire land, there is less ground lost, than when made in ridges; the ground, moreover, is less liable to wash, and the surface is handsomer for mowing than in the common way. A little fine mould, generally rolls into the furrow behind the shovel, which makes an excellent bed for the grains of wheat to push out their roots in, and the harrow resting on the ridges, levels them, and throws a proper portion of mould on the grain, nearly as light as if it were riddled. Thus the ground is levelled, but the soil being lighter in the rows where the seed lies, it will settle a little, and the plants being somewhat below the general surface, they are not so subject to injury, by

*The annexed cuts will explain the difference between the common ploughing, and the new mode.

Common Ploughing.



New Mode.



alternate freezing, and thawing in winter, on the contrary, in the common way, the plants often stand on the very heights, where by a little freezing and thawing, the roots are left naked. The grain should be harrowed and rolled in the spring, as these operations are of great benefit to the clover, if intended to be sown, for when the seeds are a little buried, the young plants take deeper roots, and consequently stand the drought better; the operation of harrowing is likewise beneficial to the wheat, for by harrowing lengthwise, a crust which sometimes forms on the surface is broken, and thus adds a light mould to the roots: the harrow too, resting chiefly on the ridges, hills the wheat, without tearing up more than five plants in an acre. I have seen also, in a time of extreme drought, that when shooting and heading, wheat sown in my way, suffered less than common. Lastly, by the free transmission of air along the rows, the straw will be stiff and not liable to lodge.

Explanation of the annexed Cut.

A B C, 5 feet 1 inch in length.

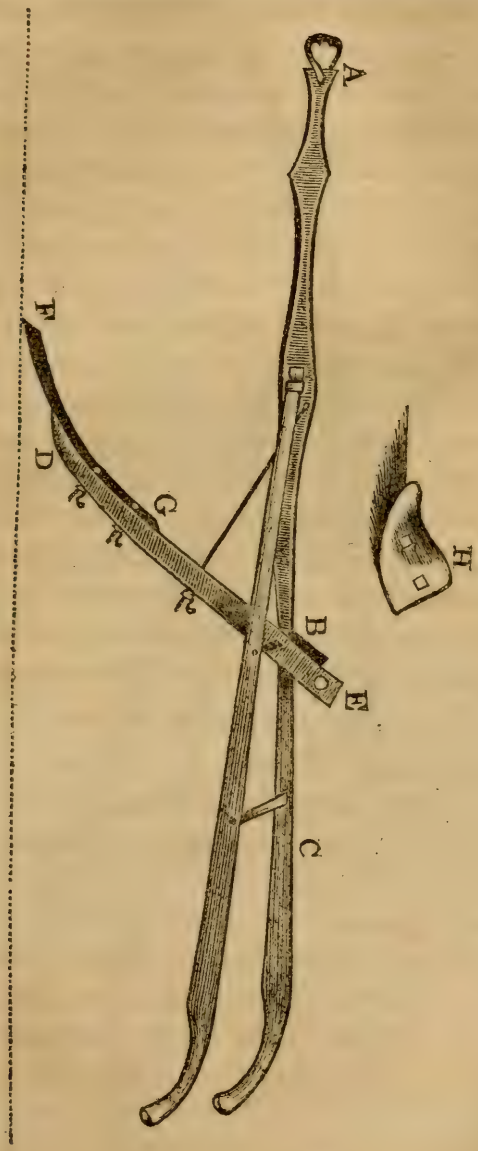
E to D, iron stud, 3 feet 4 inches long.

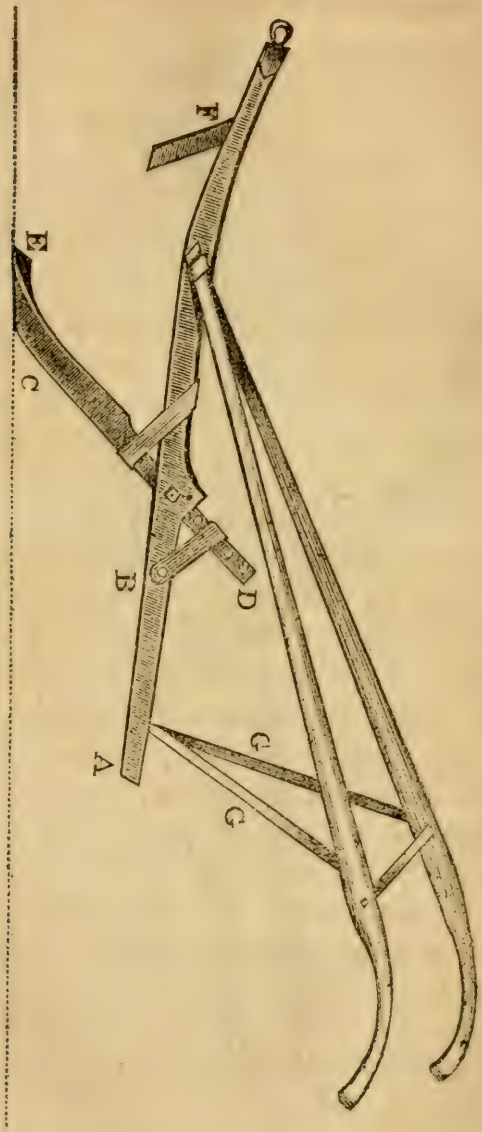
F to G, the ripper, 1 foot long, the iron 3 inches broad, screwed on to the stud.

H, the shovel plough.

The implement as represented in the annexed cut, is called a *ripper*, and is highly useful in attending a crop of indian corn, if ploughed both ways therewith, about one foot deep, when quite young, and very near the plants.

The ripper iron F G, may be taken off, and the shovel H, screwed on by means of the two screws between D and G.


A
F
D
G
h
h
h
B
E
C
H



Coulter Plough.

Explanation of the Coulter Plough.

A to B, 1 foot 3 inches.
B to end, 4 feet 9 inches.
C to D, the coulter, 2 feet 8 1-2 inches.
E to C, 8 1-2 inches.
F stud, 10 inches long.
G G, 2 feet 2 inches.
Handles, 6 feet long.

By means of the holes in the coulter D E, it may be set to different depths, as it will run in until the hind end of the beam and the stud in the fore end, run on the ground. If the hind end of the beam should wear away, a plate of iron may be put on it.*

An implement called a *miner*, is frequently used in Europe, with the same view as the *coulter plough*, described above by Mr. Kirk, viz. opening ground to a great depth: "it is made very strong, but with one share only, not having any mould board; it therefore rather loosens than turns up the earth. In deep, stiff soils, where the surface mould is good, it may be conveniently employed in the same furrow, after a common plough, in order to stir the ground to a greater depth. It is an extremely useful tool where working deep is necessary, without bringing up the inert under stratum or sub-soil, as in loosening the ground for carrots, or other tap-rooted plants, and in eradicating the roots of thistles, or other weeds which strike deep in the earth." —*Dickson's Agriculture, Lond.* 1805. *Vol.* 2. *page* 12.

* Working models of these implements, are deposited in the Society's room for public inspection.

As to the article Fencing, I have tried many kinds of trees and shrubs for the purpose: as 1st, the Palmetto Royal* of South Carolina, which does not stand the winter here. 2d, French Furze from Europe, which is handsome, but not quite hardy enough. I have at length fixed on the common locust.† I tried for seven years to propagate this tree, and at length adopted a method, by which I can make myself as sure of a plant from every seed, as from indian corn: they will grow from four to six feet high the first year. My method is,—take the trees at one or two years growth, make a ditch (with the plough) where they are to be planted, and set the trees from nine to twelve inches apart, lean one half one way, and the other half the other way, platting them together, and tye them at top, and in four or five years, they will make a good fence. The locust does not injure grain, and if the proprietor should choose to cut them when grown high, we have no timber that will bear the expence better, on account of its durability, and if cut at four, five, or six feet in height, the stumps will not decay, until there is a sufficiency of sprouts to supply their places.

[* *Yucca Aloefolia.* In South Carolina, Georgia, and Florida, this plant abounds, and makes the best fence in the world, owing to the sharp thorns at the end of the thick fleshy leaves, which project at acute angles from the body of the tree; it is called, and with propriety the "bayonet bush."

† *Robinia Pseudo-acacia.*—Lin.

Attempts to raise locust trees from the seed, for fences, have been made near Philadelphia, but have failed, owing to the destruction of the young plants by ground mice.]

New Mineral Manure for Clover.

Read December 9th, 1806.

Having been shewn by Dr Woodhouse a small quantity of a mineral substance, which had been brought for his examination from New Jersey, by Josiah Reeve, of Evesham, I wrote to the latter and requested all the information in his power to give, on the subject of the qualities of the substance, and received the following answer. J. MEASE.

Rancocas Creek, 11*th mo.* 20*th*, 1806.

Respected Friend,

I received thy letter dated the 18th of June last, and should have answered it sooner, but wished to take some time to make further observations, as well as to gain information from my neighbours and from some others at a distance. The black sulphuric substance by us called marle, is found in great abundance through most parts of the country, in a north east and south west direction, from the head waters of Crosswick's Creek, in Burlington County, along on the upper part of nearly all the creeks from thence to the southern part of Gloucester county; we find it in the banks of the streams, and in most places at the bottom of many of our wells, and it often spoils the water. On my farm, and through our neighbourhood, it abounds near the surface in the meadows, and generally in the banks or hill sides, about from 4 to 6 feet below the surface; the depth I cannot from experience say much about, but from the obser-

vations of others, find it varies from 6 to 15 feet and more. I have at thy request, brought with me to the city, for thy use, a box of it, of which I wish thee or thy friends to make a chemical analysis. The result of my own, and my neighbour's experience is, that for grass lands, about ten two horse loads to the acre, laid on the surface in the autumn, is better, if the next season prove moist, than double the quantity of any other manure, and will last longer; changing in two years rough bound meadow into almost clear white and red clover: but the last dry summer it did very little good. I am in the practice of mixing in my barn yard, or in the compost heap, the marle with the dung, two loads of the former with one of the latter, and always find when put on my fallow, that it is as good, or better than the same quantity of dung alone, and much better for the clover that follows, but in its crude or raw state, does not do on grain, the first year, except for indian corn, which some say it helps, by laying it on the tops of the hills in the spring. I put some, in my manure for my garden, and found it made the clover grow among vegetables, so spontaneously, that we have had much trouble to destroy it ever since.

From thy friend

JOSIAH REEVE.

At my request, Dr. Seybert analyzed the substance sent by Mr. Reeve, and found it to be a ferruginous clay.

J. M.

Expences and Profits of a Dairy. By Algernon Roberts.

Read April 14th, 1807.

[*Mr. Roberts having been requested by the Agricultural Society of Merion and Blockly townships Philadelphia County, to favour them with a statement of the expences and profits of his dairy, presented the following account. It was afterwards presented by Mr. Roberts, to the Agricultural Society of Philadelphia. As the quantity of land which sustained his cows, was not mentioned, the Society requested information on that head, and received in consequence, the letter subjoined to the following paper.*]

Agreeably to the request of the Society, I lay before them, an account of the butter, I sold from a dairy of twenty cows, during eight years viz: from 1st January 1796 to 31st December 1803. The weight amounted to 27835 pounds, being an annual average of 3479 pounds, or 173 pounds to each cow per year.

Cash received for butter sold from 20 cows in 8 years, - - -	$ 8276	19
Consumed in family the milk of 3 ditto,	1506	
Sucking pigs estimated at - -	320	
17 cwt. of pork at $ 6 per cwt. sustained by dairy, - - - - - -	816	
20 calves at $ 4 each, - - -	640	
	11558	19
	7748	
	8)3810	19
	476	

20 cows at 30 dollars each is $ 600 at 6 per cent, - - - - -	36	
Grain for winter food, - - -	300	
Hay, straw &c. - - - -	300	
A man and woman's wages, - -	300	
78 times expences going to market at 25 cents per time, - - - -	19	50
Summer keeping of a bull, - -	13	
	968	50
Annual expence multiplied by		8
	7748	

In the above estimate, I suppose all the sustenance of the pigs to proceed from the dairy, as any other food their dams had, is supposed not to exceed the amount of pigs used by the family, and of those sold alive: it is likewise supposed that one half the food of the other swine, consisted of the offal of the dairy. The calves were sold on the spot. The item of the family milk is founded on a supposition, that it would take three cows to give milk to a family of ten persons, a considerable proportion of which are children. It is also to be remarked, that in the autumn months of part of the years included in the calculation, there were some persons added to the family, in consequence of the epidemic fever, prevalent in the city of Philadelphia, and who caused a diminution in the quantity of butter sold. It is difficult to estimate the expences. The interest is founded upon a supposition that each cow costs thirty dollars; and the winter keep is set down as equal to her full value. The dairy is supposed to be managed by a man and woman, who are thought fully equal to the

task, and their wages as stated, a full reward. The marketing is supposed to be done by the man, who is allowed eight cents, each time for expences, exclusive of horse standing at the city stable, ferriage and turnpike toll. Nothing is allowed for the bull, except his summer pasture, as it must be bad management, if he does not sell in the autumn, for more than he cost in the spring; his manure also is to be taken into consideration. The allowance for replacing dairy cattle is thought to be trifling, as they are most frequently sold, with proper management, when turned off for grazing, for more than their prime cost; their manure is supposed equivalent to their summer pasture.

The neat profit then is $ 3810 19 for eight years; this sum divided by eight gives $ 476 27 cents; which being again divided by 20, (the number of cows,) will give the average per head, viz. twenty three dollars, and eighty one cents.

Blockley, April 20th, 1807.

Sir,

My farm consists of about two hundred and eighty acres, thirty of which are wood land, and ten of natural meadow and homestead inclosures; consequently there remain about two hundred and forty acres of arable land; which are divided into thirteen inclosures of unequal sizes: my general mode of cultivation, is two succeeding summer crops, first indian corn, and secondly oats, the stubble of which is ploughed and sown with winter grain; the succeeding spring, the land is sown with clover, orchard grass, and timothy seed. Several of the inclosures are so pestered with garlick, as to se-

clude my dairy cattle from them, of course they are applied to my horses, sheep and feeding cattle: the consumption of pasture by these I believe generally equals that of my dairy stock, therefore I suppose it a just inference, that one hundred and twenty acres (clear of garlick) would support my dairy stock, under my present mode of management, but as my arrangements of business are much blended, I find it difficult to ascertain with precision the quantity of land appropriated to my dairy cattle, for the part devoted to the dairy stock, is also allotted to cultivation, and divided between pasture, mowable, and ploughed land. I would have the above considered rather as an opinion, than an exact statement. If from it, you can collect such information as may in any-wise answer your purpose, I shall feel fully gratified; ever remaining,

Yours &c.

ALGERNON ROBERTS.

JAMES MEASE, M. D.

Account of the produce of wheat and rye, during 16 *years in Lower Merion township, Philadelphia county, and times of harvesting, &c. By Algernon Roberts.*

Read April 14th, 1807.

	WHEAT.							RYE.	
YEARS.	Bushels sown.	Months.	Dozens Reaped.	When Reaped.	When got in.	Number of Bushels.	Average per acre, each year, in Bushels.	Bushels sown.	Dozens Reaped.
1790	16	Sep. 14	296	Jun. 29	July 7	148	9		
1791	17	do. 16	328	July 3	do. 12	164	9		
1792	12	do. 22	247	do. 1	do. 9	123	10		
1793	7	do. 25	250	Jun. 30	do. 8	125	18		
1794	7	do. 18	368	July 6	do. 12	184	26		
1795	10	do. 11	333	do. 4	do. 10	166	16		
1796	14	do. 16	281	do. 4	do. 13	140	10		
1797	9	do. 21	216	do. 5	do. 10	108	12		
1798	7	do. 20	250	do. 6	do. 16	125	18	21	486
1799	8	do. 27	268	do. 9	do. 14	134	17	14	328
1800	7	do. 22	282	do. 1	do. 6	141	20	7	184
1801	10	do. 28	437	do. 5	do. 16	218	21	9	234
1802	15	do. 30	565	do. 4	do. 13	282	18	13	193
1803	10	do. 27	325	do. 5	do. 11	162	16	10	362
1804	4	Oct. 1	181	do. 4	do. 12	91	23	15	409
1805	4	Sep. 24	187	do. 2	do. 11	93	23	19	633

Wheat, 24 sheaves to a bushel.
Rye, 19 sheaves to a bushel.
Average of Rye, 13 bushels per acre.

The foregoing table exhibits an account of the quantity of wheat sown for sixteen years, the times of sowing and harvesting, together with the quantity raised. The quantity sown per acre, was one bushel. Preceding the year 1794, the wheat was sown on indian corn ground: but in that year, on a clear fallow, and the suc-

ceeding years, it was sown after oats: a manifest advantage is shewn in favour of an open or clear fallow. If it should be asked, why pursue a mode so injurious, as preceding wheat by oats, my answer is, that my ground being infested with garlic, and a dairy my chief object, oats is made a fallow crop, as the greatest enemy to garlic, that I have yet discovered.

[In forming an average result per acre, the calculation should commence with the year 1794, because previously to that year, it appears that the bad system of sowing wheat among the maize was pursued. Neither ought the result, whatever it may be, to furnish a rule to judge of the crops in Pennsylvania, because Mr. Roberts acknowledges the necessity he unfortunately labours under, of continuing a practice, which his own experience, and that of every other farmer, who has made a comparative experiment, proves to be bad farming, viz. sowing wheat after an exhausting crop of oats. Could other statements, equally accurate as those of Mr. Roberts, be obtained, of crops raised upon land in our fertile counties, which are under a regular improving course of wheat on a clover lay, a great difference would appear.

Instances might be produced, in the same neighbourhood, of crops repeatedly producing 60 to 80 shocks, and this year, (1807) 100 shocks or dozen sheaves per acre. The practice is, ploughing often, timing the stirrings, so as to destroy weeds, and deeper ploughing, avoiding an intermixture of corn and small grain crops, and never sowing, except when the earth is in a state to receive the seed advantageously, both to its cover, and vegetation. A small quantity of land thus managed, will produce more grain, with less manure, than large fields ill farmed.

The average result of the rye, will give still less than the wheat, because it was sown upon unmanured ground, as is common, while the wheat received all the manure he could make.

The dates of harvesting will be found useful, in assisting to form an opinion of the variation in our weather, and may be compared with the table, taken from M'Mahon's American Gardener, which the reader will find among the selections in this work.

Statements similar to that furnished by Mr. Roberts, from other districts of this State, or of the United States, will be highly acceptable to the Society, as they may serve to furnish a basis for a calculation, highly desirable, with respect to the average produce per acre, of our lands. They are therefore earnestly solicited from our agricultural proprietors.]

On Live Fences. By John Taylor, of Port Royal, Caroline County, Virginia.

[*The following communication from a distinguished citizen, and very intelligent and extensive cultivator, on a subject highly interesting, is not only meritorious, as it respects the execution of a plan on a scale so extensive: but affords a practical proof of the ease and profitable effect, with which other native productions may be used, as substitutes for the* thorn. *This valuable paper will pass under the respectful notice of the Society, when* Premiums *are the subject of consideration. In the mean time it is entitled to their approbation and thanks; and cannot fail to recommend itself to imitation.*]

Read August 11th, 1807.

About 12 years past, conceiving that cedar was well adapted for live fences, I planted 10,000 on the interior declivity of the banks of ditches, cut in the outside of fields (so that the cedars were within) two feet apart; but a removal of my residence compelled me to relinquish the experiment. The appearance of those cedars at this time evinces, that by proper culture they might have been formed into a good live fence.

In 1799 I recommenced the experiment at the place whereon I now live, by planting cedars round a stable yard, containing about an acre, and in each succeeding year along the ditches inclosing my farm; so that now they inclose an area of above *six hundred acres*, except a part, the fence of which is a river. The distance

planted is about six miles, and the number of cedars about sixteen thousand. This is only conjecture, but it is supposed to be considerably below the fact.

The culture applied to this hedge, is to top, weave, prune and weed it once a year, and to manure it once in a mode which will be explained. Until the last year, it was topt at thirty inches, then I began to top the cedars recently planted, at the height of twelve.

The cedars are planted on the interior declivity of the bank of a ditch, about nine inches from the fence thereon, made of stakes and cedar boughs; except at the stable yard, where the ditch being on the inside, they are planted on the similar outside declivity; the boughs which grow perpendicularly to the line of the fence, and towards it, are by its help trained into a conformity with this line; those which thus grow on the opposite side, are cut off six inches from the stem; and those which grow in the direction of the fence, or with a small inclination that way, are woven in that direction by the help of the stems, as soon as they grow above two feet long. In this wattling, the boughs should be bent as near to the ground as possible, to the fence below. The dead fence stands on the summit of the bank, between the live one and the ditch.

All the weeding I have given the cedars, has been yearly to draw the earth with a hoe, from the dead fence to the bottom of the bank, about one inch deep and two feet wide, leaving it in a ridge, with the live fence between it and the old fence; and the next year to return this ridge to the bank of the ditch, whence it came, first slightly cutting up the weeds and grass.

Except as to the hedge round the stable yard, it must be recollected, that on one side of this hedge, there is a dead fence, on the other, I have annually manured a space of nine feet wide, and cultivated it in peas, working close to the live hedge; and perceiving the vast benefit of it, I last year commenced the following mode of manuring the hedges at a distance from the farm yards, and have applied it to two thirds of the whole. The intire materials of the old dead fences which require renewal, are nicely patched on both sides of the live one, and this decaying wood and brush is covered with good mould collected from the bottom of the ditch. At the same time a new dead fence is made, expected to last until the live fence becomes sufficient. The dead fences are made of stakes and Cedar boughs, closely wattled.

The live fence around the stable yard, having been annually topt higher, as its use is to confine horses, is now about five feet high, and two wide; and is a good hedge, well filled up from bottom to top, two or three gaps excepted, made by the stable boys.

The rest are in a state of progress, graduated by their ages, some being nearly sufficient to confine horses, and others but lately planted. The excessive drought of the last year, checked their growth very much, but did not kill a single plant that I observed. Indeed I do not recollect to have seen one dead, after it had lived a year.

The mode of planting is extremely simple, rapid and certain. The cedar is taken up with a spade, in a sod, nearly in the form of a cube; two of its sides receiving dimension from the breadth of the spade, and the other

four from its breadth also and the depth of the sod; which depth cannot be too great. By a similar spade, a similar sod is taken from the spot, where the cedar is to be planted; the sod with the cedar growing in it, is deposited in its place; and the earth of the removed sod is used to fill up chinks, or is crumbled about the young plant as a dressing. The success depends upon not breaking the sod, and the smallness of the cedar. Very few will die, if any care be taken. The gaps made by the few which do die, by violence or by accident, are speedily repaired by replanting annually.

The winter months and March, are the best seasons for planting. Moisture, sufficient to prevent the ground from crumbling, is necessary. A congelation so slight as to be penetrated by the spade, places the earth in the best state for the operation; but this is seldom attainable.

The advantages of the cedar over shrubs, are 1st, its longevity. 2dly, the rapidity with which it is planted, and the certainty with which it takes root. 3dly, the absence of thorns and its pliancy, so that it can be bent wattled and worked into any form, and trained to fill up apertures, with ease and dispatch. 4thly, its being absolutely refused by most animals as food, and never injured by browsing. 5thly, the smallness of its annual shoots, rendering it far more subservient to the shears, than the thorn. 6thly, the size and rigidity bestowed by age on its branches, united with a disposition to grow extremely thick, under the pruning regimen. And 7thly, its being an evergreen, presenting an uniform state of perviousness; which is not the case with any deciduous plant.

The errors I have hitherto detected in the experiment, are, topping too high, forbearing too long to manure, and being too spare of cultivation. By beginning to top at one foot, and proceeding as the hedge fills up below, with manuring and good cultivation, I am persuaded that the cedar may, in seven years, be trained into a hedge as close from bottom to top, as box, of a breadth not exceeding four feet; and that it is more likely to become an effectual fence against hogs, than any of the family of shrubs, because it unites great density, with the inflexibility and exuberance of the tree. The hedge of that age inclosing the stable yard, is well filled up, is the best live fence I ever saw, and though originally topt too high, promises rapidly to acquire this state of resistance.

The young cedars are generally to be found near the ditches on my farm, If they are above 100 yards from the spot at which they are to be planted, the sods containing them are removed in a waggon or cart, in one layer on its bottom. In this way they are rapidly removed to the distance of one mile. If the distance be greater, the bottom of the carriage may either be enlarged, or a second and third story of flooring added, as the size of the plants may allow.

Having a farm whereon the cedar is scarce, and having unsuccessfully attempted to raise young plants by sowing the berry, and observing the surface of snow covered with the cedar seed voided by birds, completely freed from its viscous tegument, I had a parcel collected in February last, and planted them in March. The place has not since been visited by me. The idea is only mentioned, because should this preparation of

the seed cause them to vegetate, a copious supply of young cedars may be obtained, without resorting to the troublesome and precarious fermenting experiments. However provided, they must be sown sufficiently thin, to supply each with the indispensable sod.

The following, is the last idea, connected with the subject, which may not deserve to be forgotten. It is, to plant apple trees at eighteen feet distance along the hedge, three feet from the stem of the cedars. The apple trees, whose bodies are somewhat shielded against the sun, seemed to me to thrive best. The manure and cultivation required by the hedge, would I thought, present us without any additional expence or labour, with spacious and luxuriant orchards. The land under the hedges, could not be devoted to so useful a purpose. If public roads only, were by law to be thus bordered, a splendid agricultural ornament, the comfort to travellers of protection against the sun in summer and against the wind in winter, and an annual pecuniary saving to the nation by the use of cyder in place of ardent liquors, to a great amount, would be returns intirely supererogatory to the benefits of living fences, made by the manure and cultivation which these fences, whilst young, require. Under these impressions, I planted apple trees (crabs, excellent for cyder, but hardly eatable) around the hedge inclosing the stable yard, which has now spread to within a foot of the trees. These have borne, sparingly, this year, for the first time. I have never seen trees more flourishing. It is only seven years, since they were grafted. The lot is nearly a square, facing the cardinal points of the compass, and as the trees equally flourish, it is probable that live fen-

ces will be serviceable to them in any geometrical figure. The branches of my trees growing perpendicularly to the opposite hedge, have been annually pruned off, that the others might interlock the sooner, so that the trees are in the form of an espalier, embracing the hedge, rising above it, and dropping their fruit on the outside of the yard; and with the hedge bestow upon horses, the luxuries of a shelter from a cold wind and hot sun.

August 1*st*, 1807.

Account of a new Pummice Press, with some remarks upon Cyder making. By Timothy Matlack, of Lancaster.

Read March 10th, 1807.

Lancaster, February 7th, 1807.

Sir,

Colonel Johnston of your city paid me a visit, and I shewed him, as I had done some others, a pummice press that I had made for my own use; intended principally for making of wines from currants, black berries, grapes and other small fruits; but as I wished to make wine from *quinces* which is beyond question, little if any inferior to that of the best grape, and also, expecting to make some perry, it seemed best to extend its size, to those objects, especially as the encreased expence would be very small. I therefore fitted it to those objects, and as it now appears, to that of cyder making, in a way far indeed beyond my first intention. On viewing it, Colonel Johnston suggested the idea of sending a sketch of it to you, assuring me that it would not fail of a favourable reception; and I now enclose a side view of it, that will shew the principle on which it is constructed; and I trust, demonstrate that it is capable of an almost incredible force, within a *small space*, by very *simple means*, and at a very small expence; and also that it can be used with the greatest facility, and when done with for the season, can be laid securely by, without occupying much house room.

Several persons who have seen the press have expressed their idea, from the smallness of the crib, that it was

intended only for a model; not adverting to the space left for a much larger crib; nor instantly perceiving that both levers, acting *wholly within the machine*, press with equal force, both upwards and downwards; but no one who has examined it, has failed to express his opinion of its promising fair to become really useful; and if it shall prove to be so, it will afford me ample satisfaction for my trouble.

Be this as it may, I am convinced that the best chance for becoming so, will be derived from your care and attention, to which it is committed with the greater pleasure, as I confide that you will allow me the credit of a respectful attention.

I am your most obedient,

humble servant,

T. MATLACK.

HON. RICHARD PETERS ESQ.

President, Agric. Society, Philad.

[Mr. Matlack having been requested, by order of the society, to procure a model to be made, and to transmit it with further explanations, was so obliging as to comply with that request; and the model was accompanied by the following letter.]

Lancaster, February 27th, 1807.

Dear Sir,

The model now sent you under care of Col. Johnston, is on a scale of an inch to a foot.—The levers to press 40 for 1, and the cribb to contain 40 bushels,

which I think may be wrought at least *three* times, while one of 80 bushels can be wrought *once* in the common mode.

I have no wish to engage in the question of cyder making, further than to suggest this mode of simplefying the lever; the sole inconveniency of which appears to be the frequency of removing the weight; which from the unalterable law of the lever, must be proportioned to the increase of pressure. Hence each weight should be no greater than is within the strength of the attendant; or, which is the same thing, the weight of each lever should be divided for that purpose. It is planned for three pair of levers, of which two only are inserted, and the space for the third blocked; either of which a stout lad of twelve years old may handle. It is intended, that two of the three should continue to press while the other is raised; in doing of which an inch board of a foot width, and of a proper length, will be quite sufficient to support the first lever: or with a little more strength it may be *turned over*, out of the way. As to the second lever, it can be withdrawn, and replaced *in less* than a minute. But enough of the model, which it was more trouble to make than the working press, rough as it is. I chose to make it myself, rather than employ a mechanic here, because I well know, that it would require more time to get *any thing* done by them, than to make it, if I was able.

To reason against fixed prejudices is folly that ought not to be expected *beyond* the age of 70: it always gives offence, and is generally fruitless. Yet, lest it may look like sneaking from the question you suggest (with your usual address) I will venture to say the best cyders that

I have ever seen, if not all *the truly excellent*, has been pressed immediately from the mill.*

The truth is, that cyder making depends on *fermentation*; a subject less understood than any other to which philosophy or chymistry, have attended; and my knowledge of it, is just sufficient to warrant the sentiment, and to have learned, that the little that is known on the subject, it is extremely difficult to communicate, or to reduce to practice, in a country whose climate is so extremely variable as that of Pennsylvania, sometimes even in the cyder making season, so *warm* as to put the fermentation above controul; and at times soon after, so cold as totally to suspend it; so that it unavoidably commences again and goes beyond its proper point in the spring. A wort of malt and hops, fermented at 65° and separated from its yeast in due time, becomes spontaneously fine, and even perfectly bright; is a fine colour according to the colour of its materials; is soft and free from bitterness. A part of the *same wort* fermented at 76° has a cloud fixed in it, which art has not yet been able to remove; is so far decomposed as to cause the resin of the hop to offend the palate with its bitter, which grows more and more offensive by time and finally acquires the offensive bitter of the aloes. The pulp of the apple

* This opinion is so different from that generally entertained by cyder makers, that experiments are well worth making to determine the point, or to ascertain the difference which pressing the pummice immediately from the mill, and permitting it to remain some hours before pressing, would occasion in the quality of the liquor. The subject is earnestly recommended to the attention of farmers.—*Note by a Member*

forms at least a part of the yeast of cyder, and if not separated by fermentation, but suffered to remain, will decompose the cyder, and exhibit to the palate the precise bitter of the apple leaf, previously to the commencement of the acetous fermentation. Warmth is the first sensible effect of fermentation. This expands the air contained in the vesicles of the pulp, and occasions them to rise; they should then be removed; their return increases the fermentation.

Our farmers have not yet attended to the important fact of *difference in the strength and weight* of the must from the different kinds of apple, on which the successful practice of fermentation will forever depend—And which they will hardly credit until the use of Dicas's hydrometer,* or some such instrument, finds its way amongst them. To you, I may venture to say, that by even a *more accurate mode* of determining this difference, beyond the weight of rain water, I have found it to be so incredibly great as 11 to 24, which, I think (for my notes on this subject are in the city) was between the juice of the Vandever and of Cooper's sweet russett, which produces the richest must of all the apples I have examined, and I have tried very many for more than 48 years back; the next heaviest is the house apple.

Having said thus much, it would be wrong not to add, that the Virginia crabb affords a juice extremely different from that of any other apple I know of, and appears to be less liable to an excess of fermentation, the

* The appropriate name of this valuable hydrostatic instrument I do not recollect. [*It is called "Saccharometer."*]

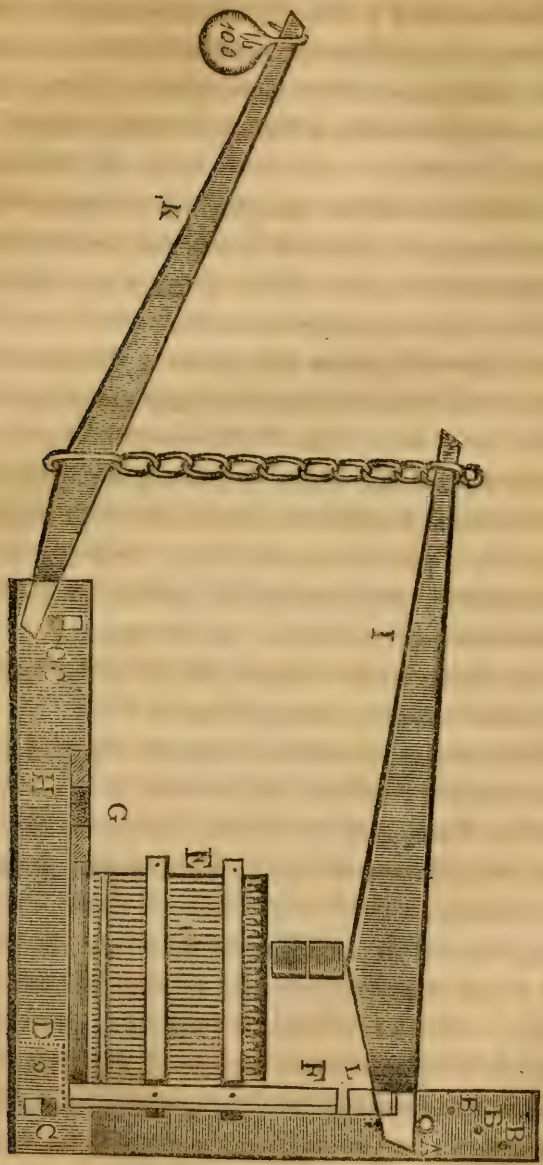
bane of our common cyder, than that of any other apple. The cause of this difference, I am quite willing to leave others to *guess at*, or to enquire concerning by more rational means, at their choice. For the truth of this important fact you may venture to take my assurance: to wit—That the *sooner* the pummice is pressed after grinding, the paler the cyder will be—the more perfectly *bright** it may be made in the cask—and the less lees it will deposit in the bottle. A moment's reflection will satisfy you, of the incorrectness of the practice of measuring the length of time which pummice should remain after grinding, and before it is put to press, by *hours*, without regard to the heat of the air at the time. You will perceive, that one season the same length of time will produce no sensible effect, which at a much warmer season would induce the commencement of an acid fermentation.

Having gone so much further on this subject, than I had intended, I cannot help asking myself the question, ought I to ask your pardon for it, or my own? Perhaps the answer should be, that I deserve it from neither. However I am certain of this—that I am with much esteem and respect,

Your most obedient and
very humble servant,
T. Matlack.

Hon. Richard Peters,
President Agric. Soc. Philad.

* The word *bright* is a term used by brewers to express the difference between what is commonly called *fine*, and that perfect *transparency* in which liquors are, alone, tasted in their purity.



Upright which stands on the inside of the side plank, six feet long.

A, An iron pin 1 1-2 inches thick, passing through both uprights, against which the toe of the lever presses upwards, and an eye bolt passing through the lever, which keeps the lever from falling, when the blocks are removed.

B, B, B, Holes in the upright, to which the lever may be removed at pleasure, to any required height.

C, C, A similar tenon and dove tail at the other end of the side planks, bearing upwards.

C, A tenon with a dove tail, bearing downward, to strengthen and bind together the side planks and uprights.

D, This dotted line shews the foot of the upright, as it extends forward within the side plank. The upright is secured by a pin represented by a . near D.

E, The cribb, 21 by 20 inches, and 20 inches high.

F, Plank side of the cribb. G, Wedges.

H, Side plank lying on the out side of the upright, 7 feet 4 inches long from out to out.

I, 6 feet 8 inches, equal to five times the length below the fulcrum.

K, 6 feet 8 inches.

L, A wedge over the plank side of the cribb not really necessary.

Though the cribb contains only four bushels, yet the press is equal to a cribb of 48 by 48 inches, and 36 inches high, which will contain 37 bushels. The facility with which that quantity can be pressed, discharged, and replaced, leaves no doubt but that a much greater quantity in a day can be pressed, than is practicable with the longest beam hitherto ever used; or with the best double screw press, now in use. The plank being prepared, it is

not more than two days work, for a carpenter, to compleat the press; and this estimation of time is not guess work, but the result of experiment. A carpenter's apprentice assisted me in the sawing of the plank for one day, and I completed it on the second day. The plank which is 2 1-2 inches thick, delivered at my door, cost me two dollars and one half, and the chain, pin, and a hundred of 4d cut nails for the cribb, is the whole expence of iron work. So that this may be considered as much the cheapest, as well as the most powerful press yet known, and any farmer who can handle a saw, an axe, and an augur, can readily make the whole; especially considering, that a strong withe may supply the place of the chain, and a tough piece of hickory the place of an iron pin.

The pressure of the weight (100 pounds) on the pummice, is as 5 times 5 is to 1. That is, its pressure downwards is equal to 2500 pounds. But, the uprights being fastened to the side planks, the toe of each lever bears the cribb upwards with the same power as the heel (or fulcrum) presses downwards; so that the actual pressure on the pummice is equal to 5,000 pounds.

The press from which this is sketched, is provided with two of these compound levers acting side by side, and consequently press equal to 10,000 weight; although the uprights are only five inches apart, and by lengthening the pin, which supports the levers only five inches, two more of those levers may be added, on the outsides of the uprights, which will press equal to another 10,000 pounds, and so infinitely.

The floor of the press is perforated with two augur holes, of an inch and quarter diameter; and on the floor

is laid a lattice bottom, which is supported by three ribs of one inch and quarter wide, and half an inch thick. Upon this lattice, an hair cloth or coarse bagging should be spread, and it will be best to spread the same cloth on three sides of the cribb, by which means the must will run off quite fine. One side of the cribb is of plank, and pressed against the uprights by the floor, which is wedged on, by double wedges; and the other three sides are tenoned into the plank side, with headed pins, long enough to be readily knocked out when the pummice is sufficiently pressed. That side of the cribb is then to be turned outward, the pummice thrown out, and the cribb returned to its place and refilled. The side planks are tenoned together, and dove tailed upwards, at the outer end, and downwards at the foot of the uprights.

The whole space occupied by the press is 13 feet 7 inches. The frame of the cribb is pinned together, so as to be very readily taken apart, into the three sides. The whole press can be taken apart in about 20 minutes, and put together again in less than an hour: and the whole so taken apart, can be laid in a box 20 inches square, and 8 feet in length.

In my press the side planks are 10 inches apart, and bottomed to receive the juice, which is to be drawn off near the second lever.

The side plank lying on the out side of the uprights, is seven feet four inches long, from out to out.

When only one pair of levers are used, as shewn in the cut, the space for the other pair, between the uprights, is occupied by a square block through which the pin at A, passes, which keeps this lever steadily in its place.

On the injurious Effects of Clover to Orchards. By Richard Peters.

Read May 12th, 1807.

Belmont, April 20th, 1807.

Sir,

It having been mentioned at a late meeting of the society, that it was an opinion gaining credit in many parts of New England, that sowing *clover* in orchards was injurious to the fruit, I have made some inquiries on that subject. I have received a letter from *W. Coxe* Esq. at *Burlington*, who has the most extensive plan in execution, for apple orchards, and fruit trees of every species, I have heard of in America. If I gain farther information I will communicate it. I wish that other members of the society would assist in this inquiry. My own observations are, that for many years my fruit (apples) have never rewarded my endeavours to profit by a large number of trees I possess. I am in the habit of cultivating my orchards, in their turn, with the usual course of crops, pursued on other parts of my farms. *Clover* occupies them, for two and three years. The fruit is always rath, or early ripe; and drops before the season for making cyder, though the produce is frequently abundant. Whether this is owing to the loose state of the soil, and its better tilth by cultivation and manure, forwarding the fruit, and producing superabundant juices, and too rapid circulation of the sap, or any qualities in *clover*, I know not. I should suppose the circumstances first enumerated, accounted for the premature decadency of the fruit, most ration-

ally. I recollect that many years ago, when my farms were in a worse state of culture, the crops of apples remained till the proper times for gathering them. Please to communicate Mr. Coxe's letter to the society.

I am, Sir,

your obedient servant,

RICHARD PETERS.

DR. JAMES MEASE,
Secretary Agric. Soc. Philad.

I am pursuing my old plan of reinstating my peach trees, lost last season by my unconquerable foe, the disease I call the *yellows*. I obtain them from different nurseries, free from this pestiferous infection. The worm or wasp I have in complete subjection. I should be perfectly disinterested in proposing that the society offer a *premium* for preventing the disease so fatal; for I shall never gain the reward.

Burlington 5th April 1807.

Dear Sir,

I am perfectly ignorant of the disease to which you give the name of the *yellows*. Nothing of this description has ever appeared among my peach trees. For four or five years past, my trees have borne well, and have resisted the worms. I have used no precaution but searching twice in the season; once in the end of July or beginning of August, and once late in September. On the first of October, my men begin to open the roots so as to leave a bason of the size of a large

wash hand bason around each tree; in this state they are left until the season of cultivation, the following spring, the ice and water which frequently fill the hole during the winter, effectually kill the worm, should it have eluded my search and descended into the roots for winter covering. I also endeavour to prevent excessive bearing, by close pruning, which I have long found more efficacious in peach, than in any other fruit trees.

With respect to orchards being injured by clover, I am yet undetermined in my opinion. I cannot think that clover in itself can be more injurious than other grasses. I have for some time believed, that annual cultivation is necessary for young orchards. I have found nothing better than indian corn. The most injurious effects from clover, I have supposed to be, the difficulty of keeping the ground in a loose state, around the trees, and the quantity of vermin enticed by the roots of the clover. I have about seventy to eighty acres comprising upwards of 2000 apple trees, from 12 years, to one years planting out, and I have every year to renew forty, fifty or sixty young trees destroyed by ground mice, during the winter. This evil is entirely confined to the clover grounds. I am continuing one farm under corn exclusively, for the purpose of promoting the growth of the orchards, and shall be very particular in my observations.

I had forgot to mention that I have directed the peach trees to be sent of young and thrifty growths. I am persuaded that large peach trees however vigorous can-

not be removed with safety in our climate; at least there can be no certainty of their success.

With very sincere respect and esteem,

I am dear Sir your obedient servant,

WILLIAM COXE.

RICHARD PETERS ESQ.

P. S. Last year I had the ground around every apple tree in my grass grounds, dug with spades from two to three feet from the stems. I mean to continue the practice hereafter, from a conviction of its utility.

[The opinion that the cultivation of clover, is injurious to orchards, is maintained by Mr. Blakesley of Plymouth, and by Mr. Ives of Cheshire, Connecticut, as appears by the publication of the Agricultural Society of New Haven.

Mr. Blakesley says, "A neighbour of mine, an observing farmer, informed me some years since, that in the younger part of his life, he had nearly ruined his orchard, by raising crops of red clover on the land; but that when his orchard was decaying, he conjectured the cause, and left off raising the clover in his orchard, when it soon recovered. I never ventured it myself. Many orchards in the country appear to me to be injured by this cause."

Mr. Ives says, "I have found the large red clover very prejudicial to my orchard. I used formerly to

raise crops of clover and mow them. But I found my orchard decaying, and immediately began to feed it, and it recovered. I have since had clover in my orchard, but have been careful by feeding it, to keep it from having any bloom; and it does not injure it, as it manifestly did when suffered to come to maturity, so as to be fit for mowing.

Mr. Chauncy in the year 1800, upon remarking to a farmer in Pennsylvania, who shewed him a large apple orchard, of about fourteen years growth, in which red clover grew, that many of the farmers in N. England considered that plan as detrimental to their fruit trees, if suffered to grow for hay, received the following reply.

"I trust, you seldom if ever, saw an orchard more thriving than this; I keep it in clover almost constantly, and generally for hay, but plaister of Paris, does every thing for clover, and is highly beneficial as a manure, for fruit trees. I grow great crops of clover with it, and it prevents any ill effects which might otherwise arise from the clover."]

New Disease in Wheat.

The following communications have been received upon an alarming disease in wheat which has appeared in Maryland, and threatens to be attended with the most serious consequences unless speedily checked.

Read June 9th, 1807.

Elkton, August 10*th*, 1807.

Sir,

I acknowledge the receipt of your favour of the 4th instant. It is with pleasure I anticipate the great use your society may be of to the farming interest.

I have nothing to communicate worthy of notice but a disease that has been for three years past in partial spots of my wheat. I call it a decay in the root. Land recently manured, or where old buildings have been, or where stacks of hay, or fodder houses have been fed from in fields, or land manured with scraping about doors, with a mixture of ashes, are the parts most affected with this pernicious distemper.

From the first to the tenth of March, the wheat affected declines in colour, its blade dwindles and draws together, resembling a bunch of sage. The principal tap root decays, small fibrous roots grow out, and small sprouts also grow up, seldom more than 6 inches high; which do not incline to stalk. In this state, the injured wheat continues till harvest.

Many of our farmers complain of this same distemper in their wheat and generally in their best lands. Where

this distemper was three years ago, it continues with a much greater spread. Its ravages are to be dreaded.

To prevent this disease is the great desire of your

Respectful friend,

Z. HOLLINGSWORTH.

DR. J. MEASE.

Delaware Mills, 7th, 6th mo. 1807.

Esteemed Friend,

I have delayed writing to thee, for the purpose of ascertaining the cause of the disorder that prevails in some parts of the country in the present crop of wheat, especially at Elkton, Cecil county, Maryland. Zebulon Hollingsworth informs me, that he lost 25 acres last year with this disease, and his present crop is considerably affected in spots especially in rich places, where old buildings or fodder houses have stood, and such places as have been manured with scrapings, (as he terms it.)

He has sent me several bunches with the soil about the roots, for examination. I find the principal root that was first formed from the seed grain, to be *injured* as if done by an insect, and I have likewise found a single egg on said root, but in a tender state. The root appears tainted and the shoots spring therefrom; such as are turning yellow break off upon a slight touch, and other buds putting out to form more stalks, though none of them have strength to come to perfection; the principal root being gone, the support depends on the fibrous ones issuing out above, and consequently never can come to a head, or if a small head should form, can-

not fill with grain. The appearance of this complaint is discovered by the roots or bunches, being a thick tuft or bunch of blades rising in a cluster without forming a stalk. I shall continue to examine further, hoping to find some of the eggs further advanced towards maturity, though could not find any in the last sent to me. I hope others will be attentive to this subject, as it is a serious malady in our most valuable grain.

With much esteem from thy friend,

CALEB KIRK.

DR. J. MEASE.

The facts stated by Mr. Hollingsworth, while they justly ought to cause serious alarm, tend at the same time fully to prove, the truth of the theory of Mr. Somerville, respecting the origin of grain insects. He supposes that they are generated in the manure made use of, being put into the earth, and covered up from the sun and air: insects he remarks in such circumstances, breed much faster, than when the same manure is left upon, or near the surface. To prevent their increase, he recommends the mixing lime with stable dung, (but not until it is completely fermented) and the application of manure so prepared, in the spring as a top dressing, when the crop is in a growing state, instead of ploughing it under in the autumn. In the trials he has made of the practice he recommends, the success has been very great. Another mode in which the insects mentioned by Mr. Hollingsworth might be destroyed, is by paring and burning the surface; the mode of performing this operation may be seen in books

of agriculture.* No other method appears to be so certain, and it ought certainly to be adopted, as it is impossible to say to what extent the evil may proceed, if not soon checked.

The following piece appeared in the news papers in the year 1804, and may allude to a disease similar to that described by Mr. Hollingsworth. The importance of such communications from farmers cannot be too earnestly inforced. If the insect, called the "*hessian fly*," be really imported, it is not too much to say, that by an early alarm, and by burning the straw of the crop in which it first appeared, the whole race might have been destroyed, and many millions saved to the United States. Legislative interference in such cases is highly justifiable, and the government of Maryland is urged to attend to the insects that affect the wheat in that State, in a manner so alarming.

UTICA, *(New York,) July 2nd.*

To the Editor of the Patriot.

Sir,

Having heard much complaint among the farmers, and others, of the destruction of their growing wheat by the hessian fly; and some from the *rust*, or *blight*, as they suppose, by the easterly wind; I was led to examine my own fields, and endeavour to discover the cause of the yellow and rusty appearance of my own wheat; particularly a small field of spring wheat, which

* Dickson's Agriculture. Lawrence's Farmer's Calender.

at an early period, made a good shew of being a fine crop; but which, all at once—or at least in a very few days, seemed wholly to droop and put on the same sickly hue which I had previously observed to the eastward of Albany, and also in the county of Montgomery. I had never seen the hessian fly, but had generally understood that its first appearance was that of a *small white maggot in the stalk of the grain, about the first and second joint*, and that the stalks, infested with the fly, or rather maggot, could easily be pulled asunder. Examining some stalks of my spring wheat, and finding them perfectly sound, and not to be separated, except by cutting them with a knife, and at the same time observing a yellow dust or rust on the decayed leaves, I hastily concluded that the defect in the grain was not owing to the *hessian fly*, but to a *mildew*, which had caused the stalks and leaves to grow rusty and perish. But accidentally observing that the roots of all the stalks which I had pulled up, appeared dead, and quite decayed like over rotten flax, I was led to examine them with more attention, when I found a number of very small *white worms*, extremely fine, and very *lively*, which I understand is never the case with the hessian fly. But of this circumstance (respecting the always torpid state of the hessian fly) I have no personal knowledge. These worms were of different lengths, from an eighth to a fourth of an inch (as well as I could judge from the eye) and moved either end foremost; although evidently different as to the force of the head from the other extremity—what I supposed the head, being longer, and of a red colour. The body of some was nearly as white as a maggot in new cheese, others of the pale green

colour of the stalk of wheat. In the roots of those stalks, most decayed, there were insects in a *quiet* or *dead state*, or more properly speaking in a state of absolute rest, and of the colour of a ripe flax seed, though not of that shape—they were rounder and longer; but in no instance as long as the live worm. I take this to be the *second state* of this destructive insect—and that the third state is probably a fly. The *chrysalis* or first remove from a worm, is not lodged in the stalk of the grain, but amongst the roots, or in the first insertion of the leaves adjoining the root. The destruction of the grain appears owing to the ravages of the worm on the fine and tender roots, *under the surface of the earth*, and the reason that so few are found in pulling up the wheat and examining the stalks, I imagine, is owing to the worm's being concealed by the dirt adhering to the roots, and their being shaken off with the dirt before the roots are examined. I am led to believe that this is a new species of worm, as it has made a more complete destruction of the *spring wheat* than the *winter wheat*. I have always understood that the hessian fly was produced from eggs laid in the young shoots of wheat *in the fall*—and that wheat late sowed, and on highly manured lands, always escapes their ravages. By the way I would observe that some of these worms were discovered in my winter wheat, which was very late sown—but they did it but little damage. My spring wheat was sown partly on land, last season in corn and potatoes, and was but an indifferent soil—the rest in a small adjoining field which had been one year in grass, and was this spring broken up in order to prepare the ground for planting an orchard. P. Colt.

Mr. Frederick Heisz mentioned at the Society, at the meeting of January 12th 1808, that his wheat suffered extremely last autumn, during a drought, from insects having a great resemblance to those of the human head; several of which were found in the main stalk of the plant, just as it left the earth. The growth of the wheat was checked, and the leaves turned yellow. A similar disease prevailed in several places in his neighbourhood, viz. in the county of Philadelphia, 11 miles up the Wissahickon road.

Improved Hay Ladders. By Moses Coates, near Downing Town, Chester County, Pennsylvania.

Read August 11th, 1807.

Waggon ladders for hauling hay or grain, may be made from 15 to 20 feet long, and spread as wide at top, as the wheels will admit.

A, a piece of scantling 4 1-2 inches thick, and 5 1-2 deep, for the bottom rail.

B B, the two top rails.

C, the sloats, set in mortices in the bottom rail, and passing through the top rails.

D D, pieces across, one at each end, to keep them from spreading.

E, the hind bolster, notched down on the spurrs or guides of the hind wheels, just before the bolster on the axle tree.

F F, two strong studs, standing nearly erect, to support the top rails.

G, the bolster at the fore end, through which the thorough bolt passes.

This bed is much stiffer, stronger, and better supported, than one made after the usual method, and is not so subject to get out of place. But its chief merit is turning easily; for having but one bottom rail, and that in the middle, there is nothing to prevent the waggon from turning as short, as if there was no bed on it, a circumstance which is frequently of very great advantage, as in turning from one cock or shock to another; the old kind requires such a large circle to turn in, that the waggon often times cannot be brought to the spot desired.

On Sheep and their Diseases. By Joseph Capner, of Flemington, New Jersey.

Read September 8th, 1807.

Flemington, June 6th, 1807.

Sir,

Agreeably to your request, I will give you any information, according to my abilities and observations, on those useful animals,—sheep.

As I am in the habit of killing what sheep I have to spare, and of selling to my neighbours, I have had a good opportunity of viewing their internal complaints, they are,

1st, The worm in their head. The smallest size which I have observed, is less than a cheese skipper, about one inch up the nose, creeping about in the mucilage; as they grow, they creep higher up, and when fully grown, they lie as high up as the cavities will admit. I have seen as many as twelve or fifteen, great and small, in one head, but commonly only two. I suppose they are produced from a bee, that frequents the walks in sheep pasture, much resembling those bees, but of a less size which pester horses in summer, and deposit nits on their hair. I call them the *sheep bee;* but where they deposit their eggs, whether externally or internally, I know not. They first begin to be troublesome about the time the honey bees swarm.

I know of no cure. The method I follow to prevent the complaint, is to smear the noses, and up to the eyes of the sheep, with tar. This practice seems to have a good effect upon a sheep, for about one month, and on-

ly three weeks on lambs, as they are apt to rub off the tar in sucking.

2d, Intestinal worms. I frequently find the tape worm, to the number of four or five, in one sheep, and four or five yards long. I lately killed a lamb with eleven: the animal was fat: these seem to be least injurious to sheep, as those in which I have found them have the fewest knobs on their bowels.

The second kind of worms resemble narrow strips of boiled parchment, cut about one fourth of an inch in length; they are discovered in the dung of the animal, and are much more injurious than the former kind, occasioning so many lumps on the bowels, as to cause great difficulty in taking off the rough fat.

3d, The third kind are more fatal, than either of the former two, but fortunately they do not appear so often. In two or three instances, the animals which were troubled with them, continued ill until they died; and upon examining their bodies, I discovered several small round worms, about one inch long, coming out of the anus.

I observe that sheep are much more healthy here, than in England. I also notice a great neglect in the American farmers, in not docking the tails of sheep, hence they often dislocate their spines, and render their limbs paralytic, by the violence with which they frisk their tails when affrighted.

I remain with esteem

JOSEPH CAPNER.

DR. JAMES MEASE.

[Mr. Capner presented to the society, four vials, containing the intestinal worms mentioned in his letter, and the bee which he supposed produced the kind he first notices.]

On Jerusalem Wheat. By Dr. John Keemle.

Read September 8th, 1807.

Philad. Septr. 2d, 1807.

Sir,

This letter with a head of the Jerusalem wheat, will be handed you by Doctor Mease, secretary to your society.—In December 1805, I wrote to Mr. Humphreys, of Dublin, requesting him to favour me with some of that wheat: this request he complied with, by sending me a small bag, containing about a quart and an half pint, which I had sown in different kinds of soil, to ascertain in which kind it would thrive best, and ripen soonest. One third part I had sown on high ground on the 15 September, 1806; this ground was not in a high state of cultivation. The other two parcels were sown in low ground, highly cultivated, one and two weeks later than the first. That which was sown on the 15th September, was fully ripe on the 12th July, 1807. The other two parcels did not ripen so soon, nor so perfectly, as the first; whence it appears that it should be sown as early as possible. In my opinion 1st Septr. would be the most proper time for sowing it.

From reading some observations on that part of the eastern country, from which this wheat was brought to Ireland, I am confirmed in my opinion of the necessity of its being early sown. From the time this wheat starts to grow, to the time of its ripening, there is very little rain, if any, in the climate of Jerusalem. This wheat requires a high degree of heat to ripen it, and as

the degree of heat in our climate, is not so high as that of Jerusalem, the deficiency must be made up by early sowing. I am informed that it does not ripen equally and perfectly in Ireland or England. This is easily accounted for. Our indian corn will not ripen in either of those countries, which being farther north than our climate by several degrees, have not the same degree of heat: consequently our climate is more favorable to it than England, or Ireland.

In the States of Pennsylvania, Delaware, Maryland, Virginia, N. and S. Carolina, and Georgia, this grain may be raised to advantage. North and South Carolina, lie in the same latitude as Jerusalem. In these States, therefore, I would presume, it will best succeed. The southern States, will find it their interest to attend to the cultivation of it, as soon as a supply can be obtained.

As to the quantity reaped from what I sowed, I can only state, that from a pint sown about two miles from town, I do not expect to get more than a peck. Notwithstanding all the care taken of it by the farmer, half was destroyed by fowls. A farmer in the neck who had half a pint, assures me, he will get a peck at least. Of the produce of the third parcel I have as yet received no information.

Considering the three severe seasons it had to encounter, I am fully satisfied with the produce. We never had a more severe and trying winter for grain than the last, much rain, little snow, and extreme cold. During the spring and summer almost every other day we had rain, which not only checks the growth of grain, but also the ripening of it

This wheat, is hardier and more productive than any we have among us: neither heat nor cold seem to have much effect on it. It does not mildew and rust as easy as our wheat. Some of the common wheat, that was sown by the side of it, in the neck, was entirely spoiled by rust and mildew, when this was not in the least affected. Its productiveness may be estimated by the number of heads on a single straw, on some there are 3,—5,—7 heads as you will observe, by those I send you. The straw is six feet high, and very stout, sufficiently so to bear its own weight uncommonly well. The grain is full and plump, differently shaped from our wheat, and somewhat larger. The Jerusalem wheat will be a valuable acquisition to our country, if it does not degenerate, of which we shall be enabled to judge by one or two further experiments.

With much respect I am &c.

JOHN KEEMLE.

RICHARD PETERS ESQ.

President Agric. Soc. Philad.

The public papers have frequently mentioned the origin of the above mentioned wheat. It appears, that a servant of an eccentric character, the late Mr. Whaley, (who for a wager undertook to walk to the holy land) brought back a small sheaf of wheat, and fixed it up as a sign to an ale house which he kept for some years after in Dublin. In time it was blown down, and a farmer who accidentally passed, perceiving a few heads, among the straw, picked and planted them. He continued to propagate it, until he had several acres

of it sown, when he sold the seed at the immense price, of ten guineas the stone. The produce was said to be greater than that of any other known kind of wheat; the stalk strong and reedy, and to be filled with a pithy substance which proved highly nourishing when the straw was cut and given to horses. The straw bears a clump of many ears, and the grain is said to yield an unusual quantity of the finest flour. I was presented by Captain Geddes, with half a pint of the Jerusalem wheat from Dublin, in June 1806; it weighed six ounces: when exhibited at the Agricultural Society, the members were struck with the shrivelled appearance of the grain, and their unequal whiteness. This led to the opinion that more than one variety of wheat, was contained in the sample. I sowed it in drills, on a spot highly prepared, but the carelessness of my overseer permitted the poultry to destroy it during the winter. Joseph Cooper of New Jersey, sowed some of the same kind of wheat in October 1805, and observed that it ripened very unequally, owing as he thought to the weight of the heads causing many of the stalks to fall to the ground. The crop of 1807, stood well, but still ripened unequally. I procured half a peck from him last autumn, which I sowed in a piece of well prepared ground, and shall carefully note its progress, and produce.

It is believed that the same variety of wheat was introduced into this country in 1792, as some of a kind answering to the description of the Jerusalem wheat, was presented to the society, and distributed among the members, but as it has been lost, it is more than probable it possessed no particular good qualities.

J. Mease.

On the Yellow Water of Horses. By Richard Peters.

Read October 13th, 1807.

Belmont, in *Blockley*, *Aug.* 30*th*, 1807.

Sir,

The following communication on the *yellow water* of horses, was made, at the time of its date, to "*The Blockley and Merion Society for promoting agriculture and rural œconomy.*" I was principally instrumental in forming this Society, 20 years ago. It chiefly consists of intelligent, worthy and industrious *practical* farmers, with whom, I feel a pleasure in mentioning, I have uniformly lived, in uninterrupted habits of friendly intercourse and confidence. As a means of combining them by some attractive object, a small, but well selected *library* has been established, out of their easy annual contributions, and occasional fines. I have had great satisfaction in perceiving the progressive information and improvement, this has afforded. It would be highly beneficial, if such societies were more generally formed through our country, for the promotion of agricultural knowledge; without which, industry and labour lose the fairest portion of their merited reward.

I have a belief, and have heard that the adventurous mode I accidentally pursued on the subject communicated, has been singularly serviceable in the fatal disease treated of. It is truly unfortunate, that *veterinary* knowledge is so rare, and so little valued by *medical characters*, that necessity compels, and accident alone favours experiments, in the hands of those, who have no assistance from professional attainments.

By permission, and at the request of the *Philadelphia Society*, I send to you a copy, to be inserted in their memoirs. *Herbs*, and feeble remedies, have been in vain administered. Some bold, and well directed course, must be taken with a malady uncommonly and rapidly dangerous, and generally fatal. My observation and even slender and unfortunate acquaintance with the disease, may furnish some useful *hints* to those, who will add to them scientific and medical skill.

I risk all observations on a subject, on which it will be perceived, I am not scientifically informed; that I may break the way, and invite those, who have it in their power to benefit and instruct agriculturists, in a branch of knowledge intirely neglected.*

RICHARD PETERS.

DR. JAMES MEASE,

Secretary Agric. Soc. Philad.

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* Those who are zealous in any important subject, cannot always avoid committing themselves, on points they deem useful. If injustice is done to me, by the supposition, that any personal motive actuates me, to treat on topics I do not profess to know extensively, it is a tax, which all who have similar propensities to do service to others more than to themselves, must, with me, agree to pay. For a great portion of my life, I have occasionally endeavoured to prevail on professional men, to assist the business of agriculture, by devoting some part of their time and talents to veterinary subjects. But until Dr. *Rush*, very lately, laid *me* under personal obligations, and my brother farmers generally, by introducing these subjects in an handsome manner, to the notice of his pupils, I have never succeeded. This entitles him to my most

"*To the Blockley and Merion Society, for promoting Agriculture, and Rural Œconomy.*

"Having, within a few weeks past, lost *three horses*, by a disorder, which I believe to be the *yellow water*, I endeavour to render my misfortune as useful as I can, by communicating all I have observed, or heard on that subject. I do this, in hopes that other members of the society will assist in collecting facts, preventives, and remedies, necessary to enable us to know, resist, or conquer, this alarming and fatal invader. I am convinced that those who depend on several *recipes* I have seen published, will be deceived, unless the disease be very mild indeed. *One* only, out of *four* of my horses

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grateful thanks. Whatever may be thought by others, of this first compliance, with my long continued endeavours, I deem it the corner stone of some future most valuable building.

Chymical professors, and those whose employments lead them to know this important assistant to husbandry, have it in their power, to render inestimable services. When I have been forced into chymical subjects, with which I have but too slight an acquaintance, some of these gentlemen have been very kind; both in their instructions, and detections of error. Others have locked me up *insolubly;* or *decomposed* my feeble attempts, without putting any thing instructive or useful in their place. *Agriculture* and *chymistry* are so intimately connected, that one who has knowledge and talents in the latter science, could not do a more patriotic service to his fellow citizens, who are husbandmen, than he would accomplish by instructing them, when requisite, on this all essential auxiliary to their prosperity.

taken with the disorder, has survived.* So that I have no reason to boast of success in the application of remedies; though this is the only subject, which gave time for them to operate. He had so many medicines administered, and so many external applications were used, that I do not pretend to say what, specifically, performed the cure. But I am satisfied, that what would, in a common case, be called *a violent remedy*, must be pursued. *Depleting*, both by *blood letting*, and, at first, *strong purges*, I should depend on the most. Few know the great quantity of blood, a tolerably sized horse can lose, without injury. A *gallon* at the first bleeding, and *half a gallon* every day, for three or four days, will not be too much. If the pulse continues to be fluttering, tense, or indicatory of fever *afterwards*, the *fleam* should be used: and the quantity taken away may be small or large, according to circumstances, which must govern in all cases. Small and repeated bleedings, at this stage of the disease, shock the system less, than few and very copious blood lettings. *Nitre* should be given in all the draughts, or drinks and drenches, in large quantities;—three or four ounces

* He is now living in perfect health; and is 25 years old. He passed a great part of his long life, as a carriage horse. He is now on the farm; as active, laborious, fat and sportive, as any horse of his size possessed either by myself, or my neighbours. If it be said, *his constitution helped out the cure*, and even vanquished both his disease, and *the remedies*, I value him so much, that I freely yield him all the credit, he is entitled to, on this account. R. P.

per day. *Gruel*, when the horse could take nothing else for his sustenance, was given in drenches frequently. *Injections*, to produce speedy evacuations, composed of any thing *cooling* and *laxative*, are very useful. I used a decoction of the *black snake root* and *peach leaves*, with oily *shad pickle*, *salt*, *soap* and molasses, at different times, and in various combinations. *Brewer's yeast*, was also plentifully given, in drenches and clysters. All my sick horses, one excepted, took some *calomel*. To the one recovered, the mercury was administered, in various ways. It was given *in balls*, *licked* in with *salt*, and *mercurial ointment rubbed in*, near the *region of the liver*. This horse, by the advice of an experienced friend, was *rowelled* and *blistered*. As soon as the *blisters* (produced by the *potatoe fly; (Lytta vittata)* a most powerful vesicatory) rose, he began to *salivate* freely, shewed evident signs of recovery; and continued mending from that moment.

The first *purges* should consist of *aloes* and *calomel;* two ounces at least, of the former, and two drachms, of the latter, with half an ounce of *creme of tartar*.* If the *clysters* are rejected, the *rectum* should be *raked* by a small hand and arm; and the indurated fœces removed. I am confident that *rowels* and *blisters* are very efficacious, as auxiliaries. The rowels were fixed between the fore legs: the blisters on the soft parts, under the belly and throat. The short hairs were shaved off, to

* The bile being acrid and calculated to stimulate and promote the peristaltic motion of the intestines, *acids* should not be used too plentifully. Some distinguish between mineral and vegetable acids, in bilious cases.

admit their application. On conversing with medical gentlemen, I found varieties of opinion. Some condemned the calomel—some the bleeding;—both as to the remedy and quantity—and some recommended both. I should have been perplexed, had I not considered it a case which nothing could deteriorate. The *first* victim died in a few hours, without furnishing any materials for disputes about remedies. A fruitless attempt was made to bleed him and *he took no medicine.* The *second* died in two or three, and the *third* in eight days. Bleeding was freely, but ineffectually, used in the case of the second horse. The third was bled comparatively little. The survivor was bled plenteously, and took mercury in great quantities; though one of the *faculty* told me *he had not taken enough.* I found them out of their usual track of practical intelligence, when the diseases, or cure, of quadrupeds were in question.

A friend (Col. S. Miles) some years ago, at his iron works in Center county, had a number of horses seized with this disorder, and lost none: though the horses, very generally, through the neighbouring country, died of this disease. He cured by immediate and plentiful *bleeding* and *nitre.* He took, at various times, from 6 to 8 gallons of blood from an horse. The most was drawn at the first bleeding. Another, who has been very successful, cured, by one or two copious *bleedings*, a violent *purge*—and afterwards, gentle *opening medicine*, and *nitre.* But, *above all*, he recommends *cleanliness*, *good nursing*, and repeated *rubbing*, not slightly, but *laboriously.* The horse should be clad, and *kept from sun*, *night air*, and *dews.*

A medical gentleman recommended the mode of administering calomel to be,—suffering the horse to lick in thirty grains of *calomel*, with *salt*, three or four times a day. This method had been previously pursued. A servant was slightly salivated, by improvidently letting the horse lick the *calomel* and salt, frequently, off his hand. The same physician informed me, that the *calomel* entered the system the soonest in this way; and that, in a foreign country, from whence he came, he had known horses cured of this disease by *calomel* thus given, with the addition of *bleeding* and *purging*.

The whole of the *cure*, I am convinced, depends on *attacking the complaint in its first stage*, with depleting and cooling remedies. After a certain point, which occurs probably in the first 24, or at farthest 48 hours, it seems to me, nothing will cure; yet every thing should be pertinaciously attempted.

I shall not enter the lists, for or against *plentiful blood letting*. The *lancet* is held by some, in human subjects, to be the magick wand of *Hygæia;* and by others, the minister of death. So may they deem the *fleam*, applied to horses. Yet notwithstanding the prejudices against it, I do not see what other chance there is, in a disease so acute, that the subject of it may fall a victim, before any other depletory remedy can operate. Twelve or fourteen, at least, and often twenty-four hours, elapse, before any medicine taken into the stomach of a horse, has its effect. Purges and clysters only can be administered with effect and success. No *emetic*, if it were proper, *operates on an horse*. *The intestines* of an horse, if extended, measure from 30 to 36 yards in length; and the *peristaltic motion* is slow, as it is in most animals

where the intestines are in an horizontal position. Those of a human subject are, generally, in length, six times the height of the person; and this proportion holds in many animals. So that *purgatives must have time;* and this in desperate cases, is peculiarly precious. The pressure on the morbid part, should be lessened, for its relief, as soon as practicable. When or how to hit the true point of depletion, either by bleeding or purgatives, I do not profess to know. The *first* is certainly more within controul, than the *latter*. The *pulse* must direct: if the pulsations were quick, or unequal and fluttering, and the skin hot and dry, blood was taken from my horses; but in small quantities at a time, after the first copious depletions.

I have no theory to establish, but candidly mention facts and opinions, that some stand may be made against this dreadful foe, which attacks so useful and valuable a part of our property.

It is to be earnestly wished, that intelligent *medical characters* here, would turn their attention to the disease of that noble animal, *the horse.*—The companion, the faithful servant, and friend to man,—he deserves our grateful attention, and care. He shares and lessens our toils, promotes our health, administers to our comforts and amusements, fights with us our battles, and contributes largely to our wealth and prosperity.

In *England*, and other *European* countries, *Societies* and *Professorships* are established, and patronized by their governments, for the promotion of *veterinary* knowledge. Enquiries on this subject would be *honourable* to the most eminent among our medical men. Their differences of opinion, for such there will be,

would agitate questions, and bring to light useful facts, and *remedies* would follow.

The disagreements in opinion, whether the *yellow water*, be *endemial* (if this phrase can be properly thus applied) or *contagious*, are as great, and as unsatisfactory, as are those in the case of *yellow fever;* to which it seems to bear some resemblance. The wisest course, is not to risque a well horse, among the sick.

The remedies are by no means well ascertained. *Nitre* and *sulphur*, *creme of tartar*, *antimony*, and such drugs, may sometimes answer as *preventives*, or gentle *aperients* and *sudorifics;* but are, of themselves, too feeble, *when the disease is fixed. Balls* composed of *mustard* and *camphor*, are said to be preventives. I have experienced the efficacy of *camphor*, given to *sheep* tainted with the *rot.* Pills of *camphor* given to *poultry* I have found very serviceable this season; having saved many by them, from a fatal disease, of which great numbers died. I lost few or none of those, to whom the camphor was given. I should think *mustard* and *camphor* too heating, if any fever appeared in a sick horse, unless applied in *cataplasms.* The *pulse* of an horse beats from 40, to 45 times, in a minute. If it exceeds 45, he is feverish. The pulsation may be felt in any of the arteries; particularly those of the neck and breast.

The symptoms, I cannot accurately, or technically describe. The disease first appears in a dulness of the eyes; the whites whereof are *jaundiced* or *yellow.* But they frequently, at intervals, become bright; and flatter with hopes of recovery. The ears hang, and are seldom erect, or pointed. The tail is often projected horizontally, with a quick motion, and dropped in a man-

ner different from that of a sound horse. A frequent inclination, without the capacity to stool, is perceived. The flanks are tucked and hollow; and partial *shiverings* are frequent. The hind legs are stiff, and straddling wide; but finally all the limbs fail. The horse falls, and in his agonies, works round on his side; describing a circle, with his hind feet, on the ground, as he is seized with paroxysms at irregular periods. Hence some country people call the disorder "*the circles.*" Sometimes he perspires freely, perhaps from pain, but commonly the skin is dry, and the fever ardent. He will eat at any time; but cannot swallow much. Some of my horses died with the food in their mouths; taken in when drawing almost the last breath. The blood is thin, and the *serum yellow.* It is for the most part dissolved into water, highly tinged with *bile.* It deposits the *crassamentum*, in a livery mass, of a deep flesh colour, sometimes in unconnected lumps. Sometimes the blood is covered with a tough or buffy skin, full of bubbles, or watery blisters. The *smell*, arising from the sick horses, was remarkably fœtid, and different from that of an healthy horse.

My dead horses were opened. Nothing was discovered the least injured, but their *livers;* and these were alike affected, but not all in an equal degree. It is an *hepatic* affection; and as a farrier who attended *my anatomical theatre*, and had opened many horses with this disease, called it the "*liver disorder*," for want of a more appropriate term. The morbid parts of the *liver* were hard and scirrhous, and of a darker colour than the sound parts. The contents of the parts affected were dry and friable; and might be rubbed to pieces with the fingers.

They resembled the stuffing of a boiled blood pudding. The whole *liver* of the horse who died last, was reduced to one fourth of its usual size, and on the parts near it, there was some redness, or inflammation. The disease appears to be an highly malignant *bilious fever*. The *secretion* of the *bile* is obstructed by the morbid state of of the *liver* and the *gall* is retained in the blood: and thus tinging that and the *urine*, possibly gave the name to the disease, of the *yellow water*. The *horse* is among the few animals, having *no gall bladder*.

The horses in one stable (in or near which I find no putrid taint, there being nothing but what is common about stables) were alone affected. The horses on my farm (those diseased being family horses, used in a carriage, and for riding) are yet in health.* Their feed has been chopped corn, rye and cut straw; which some object to, at this season (July and August) unless the horses are hard worked. Indian corn is peculiarly heating. A change of food is best. For family horses, used irregularly, and stabled constantly, the general food should be oats and hay. Flax seed, and chopped grain or shorts, should occasionally be given, with some *sulphur and nitre*. *Air*, *exercise and cleanliness*, should never be neglected. My horses were generally kept in the stable, in which I never before had a sick horse. I have since heard of horses dying of the *yellow water*, that had not been *stabled since* winter. The facts as to the health of horses *stabled*, *or pastured* entirely, are so various, that no accurate decision can be made. From

* None of the farm horses became diseased. But several in the neighbourhood were affected.

what I have collected, it appears to me, that those at grass, exposed to hot days and damp, dewy and chilly nights, are the most subject to this disorder. Stabling or *sheds*, to cover them at nights, would be salutary. A member of this society (our vice president, J. Curwen Esq.) lost an horse with this disorder, kept in a large pasture field, without communicating with any other horse, for a great length of time. Two or three, among 30 or 40 others, have died in livery stables, with the *yellow water;* and none of the rest have caught the disorder.

I omitted mentioning, that, as soon as I perceived my first horse to be ill, I turned the other three out of the stable, on an extensive lawn, or open field. They were playful, and coursed violently, for an hour or more, through my grounds; and induced an opinion that they were safe. But this exercise *excited* the lurking disease. For in a few hours, one fell apparently lifeless, and shortly afterwards died. He was raised on his legs, for some time previously to his catastrophe, by a copious bleeding. The other two, though less affected, shewed for the first time, symptoms of languor, and stiffness in their hind legs and quarters.

The *tonsils*, or almonds, of the ears, of horses dead with this disorder, have been found (as I have heard) much swelled. I have been told of cures performed by the *cautery* [hot iron] applied behind the ears, and an incision being made, it was stuffed with *salt;* so as to produce *suppuration*. I much doubt whether the disorder was the *yellow water*, thus cured. This is not a disease so local, as are the *glanders*, *strangles*, or *vives*. It is not attended with *defluxions*, like a common horse disorder.

In the British *Museum Rusticum*, there is an account of the *yellows*, or *jaundice*. Some of its *diagnosticks* are similar to those of the present disease. It is owing to an obstruction of the *liver*, and the blood overcharged with *bile*. *Bleeding* in this case is forbid; but I doubt the propriety of this prohibition. The *vitality* of the blood, which no doubt to a certain point is true, is a favorite doctrine in *England*, among some of their physicians; prejudices against plentiful bleeding are there strong, (whether these are proper or not, I do not undertake to decide) and their climate does not produce malignancy in febrile complaints, so much as do the ardent heats, and variable temperatures, of our atmosphere.

If this, perhaps too prolix, account of what I have experienced and collected, furnishes the means of saving any valuable horses, or affords *facts* for more intelligent enquirers, it will be some recompense for my disasters. At any rate, this almost resistless destroyer, should add to our motives for using more *oxen*, and fewer horses, on our farms. *Good* will then arise out of *evil*. Providence afflicts us with partial *evil*, to rouze our attention to measures promotive of general *good*.

Since writing the foregoing account, I have heard of many horses having, during this season, perished with the same disease. *Partial* losses have occurred among an assemblage of many horses, and the rest remained in health. They were *fed* in various ways—some *stabled*, others at *pasture*.—From this it should seem, that there was nothing peculiarly noxious in my mode of feeding; or in the local situation of my stable. I have heard of several remedies; one composed of herbs,

much used in *Kentucky*, where this disorder has been prevalent and fatal. When more accurately informed, I will communicate the result of my farther enquiries."*

RICHARD PETERS.

Belmont in Blockley, September, 1799.

* August 1807. Every thing I have since been informed of, convinces me of the inefficacy of palliatives, and feeble applications, or remedies. There is no chance of saving an horse *when the disease is fixed*, but by some such powerful course, as is before mentioned.

A respectable friend, *Samuel Chew* Esq. of or near *Chester* town *Maryland*, informs me that the *yellow water* has been rife, and has lately carried off many horses in his neighbourhood. He lost four, after following the mode I pursued. Too copious bleedings are there condemned. But he saved a horse, with little or no bleeding, and the free use of mercury; with the other auxiliaries I mention, viz. cover, rubbing and good nursing. Whether the blisters were applied or not, I do not recollect. He agrees with me (and I have heard of various instances) that if the horse lives, till the calomel touches the mouth, his recovery is ensured. The chances are against any horse taken with the *yellow water*. Without powerful remedies, his fate is fixed; and with them, uncertain. It is better that, by bold remedies, some should be saved, than that all should perish.

I have not yet been able to discover any local cause, for the infection of my horses. Unless a *pit*, into which the *muck* was thrown immediately out of the stable (deep and walled round to hold a great quantity of manure, and covered) may have assisted to promote, or caused the disease. The *vapour*, or *fumes*, of *fermenting muck*, must be noxious. I have long banished all *pits* and *dung holes*, as being injurious to ani-

[The utility of bleeding and other depleting remedies, in the yellow water of horses, is further shewn by

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mals in their vicinity, and preventives to the equal fermentation, and putrefaction of the manure. The receptacles for dung *under stables* in *cities*, and *under barns*, in the *country*, ought to be abandoned. Those whom necessity, or convenience, obliges to use them, find arguments in favour of their innocence, and even salubrity; in which, I must be excused for my incredulity.

A *stercorary* should be at some distance from the stables. It is best for its *bed to rise* about two feet in the *centre* like the *back of a tortoise*, with *channels* round it, to conduct the *sap* into a small *well*, or *reservoir*, which may be *pumped*, or *laded* out; and the *drainings* returned on the heap. Those who choose it, may have the *bottom paved*, and surrounded by a *stone wall*, 3 feet high; on which the sills of the frame for the *roof* may lie. It should be *covered* by a roof of *wood*, or *thatch*, on *posts;* open at the sides for air, and *railed*, or *stripped* round, high enough to prevent access by cattle; whose *treading* or *poaching* the heap, impedes its regular fermentation. *Spouts*, or *troughs*, at the eves of the roof, may be furnished with small *cross troughs*, to lead in rain water occasionally: though it is seldom required; as its own juices are generally sufficient, for the supply of the necessary moisture to the dung. Under the pitch of the roof, over the heap, there may be a *pigeon house;* and *roosts* for *poultry*, whose dung would encrease, and ameliorate the whole mass. The square of the frame, should be about 8 feet from the bed; that carts, &c. may be admitted to enter, with convenience. Those who experience its utility and value, will never regret the expence. A parallelogram is the best ground plat. In a British publication (I believe in a communication to the Board of [illegible]ure) I have seen a draft and description of an excellent stercorary, on the plan I mention.

the successful practice of two medical gentlemen, who have given an account of the disease, and of their modes of treatment.

The late Dr. Sayre has recorded the prevalence of the disease, in one of the most highly cultivated countries in New Jersey; abounding with rich natural meadows. The symptoms were, loss of appetite, incapacity for labour, costiveness, heaviness of the eyes, great heat, high coloured urine, cough more or less severe, and frequently an enlargement of the belly and limbs. The blood when drawn, was extremely buffy, exhibiting a covering of coagulable lymph, more than an inch thick. Large glandular swellings occurred about the throat, which suppurated, and such were more apt to recover. Horses uniformly stabled, fared worst. One dissection shewed adhesions among the contents of the belly, enlargement and blackness of the liver, and effusion of water into the cavity of the belly.

Dr. Sayre had a horse attacked by the *staggers*, during the prevalence of the disease, and as he believed it to be only a variety of the yellow water, the force of the disease being directed to the brain, he took away more than thirteen pints of buffy blood, which caused a temporary alleviation of the disease. In a few hours after, on a return of the disease, seven more pints were taken away: a purge of a drachm of calomel, and 3 drachms of jalap was given.—Bleeding to the same amount as the last, was performed again, the next day, in consequence of a return of the disease. In the evening, the horse began to nibble a little grass for the first time, since his illness, and the next day, appeared free from complaint.—*New York Med. Repos. Vol.* 3. *page* 342.

2. Dr. John Stevenson, of Newtown, Worcester county, Maryland, says that his riding mare shewed symptoms of indisposition, after a severe ride, in a cold N. E. rain, about nine miles, and *standing out of doors all the succeeding night in September*, 1805! The symptoms were, a dull, heavy, sleepy look, reluctant gait, strong pulsation of the arteries, hurried respiration, frequent micturition, but the urine not altered, great thirst, white tongue, hot mouth, wasting, *appetite good.*

From the 1st of October to the latter part of November, she was bled twelve times; and upwards of eleven gallons of blood taken away. The operation was indicated by the continuance of strong pulsations. Nitre in doses of one ounce, and twice tartar emetic, in doses of twenty grains each were given. An obstinate costiveness attended, which required large doses of aloes and calomel, to produce even a slight effect.

Her appetite failed in the progress of the complaint, and she wasted in flesh. After the alleviation of the symptoms, and the partial return of appetite, two drams of sulphat of iron, (copperas) dissolved in her drink twice a day, appeared to have a good effect. Half a pint of brandy also, mixed with the same quantity of water had a considerable effect upon her appetite. Dr. Smith feels confident, that "had he discovered the nature of the disease sooner, and adopted rigorous measures with it at first, and succeeded well in the use of cathartic medicines, he might have effected a cure in half the time."—*See Med. Museum, Vol.* 4. *page* 35.

J. Mease.]

On Gypsum. By Richard Peters.

Read October 13th, 1807.

I often receive a variety of enquiries in letters from distant places; and in conversations, with those who strew the *plaister of paris*. I find some are still doubtful as to its use, or permanently beneficial efficacy. I had supposed, that this substance was now so well known; and all its properties and uses, so well established; that intelligent farmers, in all quarters, were perfectly acquainted with every thing relating to it. I am not therefore over confidently impressed, with the importance of any opinions I may entertain *at this time*; when all the information I possess, and most probably much more, must be generally dispersed. If length of experience were necessary, as an additional proof, it would form almost the only consideration, added to the requests made to me by several respectable friends, which would justify to myself, any idea that my testimony, in favour of this great auxiliary to our agricultural prosperity, is of any consequence, at this period. I can add nothing of essential use, to the statements of facts and opinions contained in the publication I made on this subject in 1797. I have had no reason to alter, or retract, any opinion I had then formed. On the contrary, my experience, since that time, has uniformly confirmed them. Thirty seven years have now elapsed, since my first acquaintance with the *gypsum*; and its agricultural uses and properties. During the whole of that period (saving an interval occasioned by the war)

I have unremittingly continued the free and extensive use of that substance; and have not, in a single instance, had occasion to repent, that I had used, or recommended it. It is on the contrary, among my most pleasing recollections and reflections, that, more than any other individual, I was instrumental in its general introduction here; and in spreading throughout the country, a knowledge of its existence, qualities, and benefits. The success attending such efforts, (amply repaid by the gratification they afford) will be seen in all quarters, and the general amelioration in husbandry, is a most estimable reward.

So far is the *gypsum* from injuring, by frequent repetition, the soil to which it is applied; that I am persuaded it will perpetuate its fertility, if the husbandry be good; and common prudence, and attention to changes, and cleanliness of crops by destruction of weeds, be practised. On many parts of my farms the applications of plaister have been at least, ten times repeated, in rotations; and other parts annually, in small quantities.

If there be any difference in perceptible effect, I think it favourable: the crops of clover are not so over abundant; but more regular and certain, than they were in my first essays. In the principles, on which its operation can be most probably accounted for, I am confirmed; by invariable experience. The decayed, or putrefied substances on which the *sulphuric acid* operates, or by which it is operated upon, must be replaced; when the use of *gypsum* has exhausted, or neutralised them. This renovation may be produced, by turning in green manures, or animal substances: or strewing the plaister on a top dressing of

rotted dung, compost, or ashes, to which it gives remarkable activity. I do not profess so accurately to know causes; but only, with confidence, relate effects on vegetable products. The first must remain conjectural; the latter are too visible and striking to continue disputable. It still evinces the like effects; with similar materials to work on. What in my compendious compilation, I threw out as a conjecture; is found on experience, with the strongest appearance of probability, to be the chymical principle or agent of its operation. When I first mentioned this to the late Dr. *Priestley;* he received it with hesitation. But some years thereafter, he told me he was convinced of its correctness. He had received information from *Europe* (I think from *France*) confirmative of the opinion, that whatever substance contained *sulphuric acid (oil of vitriol)* would produce similar effects in agriculture. He told me, that our then minister, Mr. *Livingston*, had observed the *Flemish* farmers applying burnt *pyrites*,* in the same manner, and for the same purposes, we use the *gypsum.*

The first time I saw the agricultural effects of the *gypsum*, was several years before the commencement of our revolutionary war; on a city lot belonging to, or occupied by, Mr. *Jacob Barge*, on the commons of *Philadelphia.* He was the first person who applied the *gypsum* in *America* to agricultural purposes; but on a small scale. This worthy citizen still lives, at a very

* Mr. Livingston's account of the mode of preparing this substance and the particulars respecting its use, are annexed to the present volume.

advanced age. He informed me, that he had communicated his knowledge of it to one or two persons in the country; I think to the late Mr. *Thomas Clifford* and another. He shewed me a letter, *in German*, from one who had gone over from *Pennsylvania* to *Germany*, for redemptioners; as was customary at that day. The writer sent over a specimen of the *gypsum;* and desired Mr. *Barge* to seek for land in this then *Province*, in which it could be found. It was, probably, to assist in this object, among other considerations, that I was taken into a secret, then utterly unknown to others in this country. But from that time to this, I have not been able to discover any quarries of *gypsum*, proper for husbandry, in this, or any other of the *United States.* There are, in a variety of places, *gypseous substances.* On the waters, far south, to wit, on the *Alatamaha;* and the other parts of that region, *gypsum*, of the purest and best quality, and in immense quantities, is to be found, easily accessible. The mountains skirting the *Alatamaha*, are formed of *marble* and *gypsum*, in many parts; appearing like artificial walls on the sides of the river. The quarries in *Nova Scotia*, were to us unknown at the time of the introduction of the *gypsum* here. *Burr mill stone makers*, and *stucco plaisterers*, were the only persons acquainted with any of its uses. From one of the former (the late *John Brown)* I procured a bushel; which enabled me to begin my agricultural experiments; and I faithfully pursued and extended them, as I obtained more means. A quantity imported as ballast (I believe 20 tons) by the late captain *Nathaniel Faulkner* of *Philadelphia*, then in the *London* trade; and thrown out on a wharf, without knowledge of its value, was the first

important foundation, on which this extensive improvement to our husbandry was established. With this, Mr. *Barge* began the business of pulverizing the *gypsum*, first in an *hand*, and subsequent to this, in an *horse mill;* and soon afterwards, it was carried on in a *water mill*, in my neighbourhood. Such mills are now to be found every where; brought to the highest state of perfection. When I had convinced myself of its efficacy, I disseminated the knowledge I had acquired, through many parts of *Pennsylvania;* and sent samples to *Jersey*, *New York*, and I think, to *Delaware* (then called the *Lower counties)* and *Maryland*. But my success in obtaining credit to my assertions, or in procuring assistance in prosecuting experiments; was, for a length of time, very limited, and discouraging. I had no concern in the manufacture, or any other object in the communications; but one founded in a desire to propagate a knowledge of this valuable acquisition. The person who wrote from *Germany* to Mr. *Barge*, informed him (with what correctness I know not) that the discovery was then of no long standing in *Germany:* and that it had been *accidentally made by a labourer*, employed in mixing *stucco mortar*, at a large building. He saw that the path used, or made, by him, in going from his work to his cottage, threw up a luxuriant crop of *clover*, in the succeeding season, when all other parts of the field exhibited sterility. He attributed this extraordinary vegetation, to the dust flying off his clothes; and in consequence of this idea, he strewed offals of the *gypsum*, near his cottage. The effects astonished every spectator; and he received from the *Edleman*, or landlord, a reward for divulging the secret. Whether this *Ameri-*

can voyager had better information, than most of the *travellers* and rapid tourists through the *United States*, who have amused the world with fanciful, hasty, and, too often illiberal and malignant tales about us and our affairs, I will not undertake to determine. But I have no doubt of *his* sincerity, and belief in the information he imparted.

An *English* gentleman, Mr. *Strickland*, I with pleasure, except from the mass of temporary residents, tourists and *travellers* in and through our country.—He has published an account of his observations here, which are chiefly agricultural, with more attention to truth and accuracy, and I am persuaded with candid intention. But he is not without some prejudices, and is misinformed, in some instances. In one particularly, as to the *gypsum*, which is only important, because it is an item in the catalogue of his mistakes. He attributes the introduction of the plaister into this country, to the *Germans of Lancaster county* in this state; to whom merited compliments are paid, for their industry, and other good qualities. But this assertion is, so far as it respects the *gypsum*, entirely unfounded. When I first sent samples of the *gypsum* into that county, very soon after I was accquainted with it, I perceived the *Germans* there, to be totally ignorant of its existence, and of course, of its agricultural uses. More than ten or twelve years elapsed, before they could be prevailed on to use it freely. In combination with all their valuable qualities, they have some reprehensible alloys: their

prejudices are inflexible. Some of our *Germans** at this day, believe the *gypsum* invites *thunder and lightning*; and, on the approach of a thunder storm, turn out of their barns and houses the vessels containing this substance. But generally their prejudices are gone, and they use it abundantly, and profitably.† Their county

*Thus we stile those descended from the original settlers from *Germany*, though they are born here. In the cities and large towns, of this and other states, their habits and manners change from those of their forefathers, in the greatest degree, and assimilate with those of other citizens. Insomuch that the service in their churches, is occasionally (and by many desired to be alternately and regularly) performed in the English tongue. But in the country, their originality, both of language and manners, is most generally preserved. In many parts of this state, in *German settlements*, I have met with adults of the third generation, who could not speak English. I could not succeed in enquiries of the most trivial nature, in any language but *German*.

† I have given too many, to me gratifying, proofs of my regard for the people of Lancaster county whose industry and agricultural merits I have long admired, to admit a supposition that I mention these circumstances in derogation of them.

Knowing the efficacy of plaister applied to leguminous crops, I many years ago suggested to some farmers in that county, the covering their fallows previous to wheat, with the *field pea*; and procured seed for them. I was informed that it had succeeded so as to be extensively profitable: insomuch that one of them told me he had gained as much, in some years, by his pease, as by his wheat. I have not lately enquired about this culture; or whether they continue to sow, or plaister their pease.

is for the most part, a lime stone country. The plaister

I presented, several years ago, to my late most worthy and lamented friend *General Hand;* as a trustee for its introduction into the county, a valuable imported *ram* of the broad-tailed breed of sheep obtained off the *mountains* of *Tunis*, by the present General *Eaton* when consul in that regency. This ram has improved the breed of sheep in *Lancaster county*, and the country adjacent, to a great extent. I know not any breed of sheep superior, and few equal to it. Its fleece is of the first quality; and the valuable points singularly good. I regret that by accident, the old ram has been lately killed; but I have the full blood in his descendants. No other African sheep is to be compared to this species; either for fleece, fattening, or hardihood. It bears our severest winters without shelter. Some of the best lamb and mutton sold in our market, are of this breed; which is now spread through many parts of this state and Jersey. It has been done *gratuitously*, when I supplied the stock. I mention this, because I failed in an attempt to introduce a young ram, into a wealthy neighbourhood of another county. He was refused, under a pretext or false notion, that their pastures were too luxuriant for store sheep: but I afterwards learned, that added to this mistake (easily remedied by increasing their stock and profitably consuming their abundant herbage) an apprehension was entertained that an *heavy charge* would be *presented*, with the ram. All the satisfaction I desire for my disappointment, is, that those who have *disappointed themselves*, will have the grace to be ashamed of it. In every other instance, the benefit was received with the same spirit, which prompted my bestowing it. The over luxuriance of their pastures, was produced by plaister, *generally on limed lands*.

perfectly agrees with their *limed lands;* contrary to an opinion entertained in *England.*

With all this prejudice, among some of this industrious people, who are practically employed in the labours of the field, the literary characters among the *Germans*, here and in *Europe*, are of a very different cast. Some of the best treatises on husbandry and rural œconomy, and topics connected therewith, are to be found in the *German* language. Several of my *German* friends have, from time to time, obligingly gratified me, by sending for my perusal, agricultural books in this language. I have read in them, some of the best discussions, both practical, philosophical, chymical, and œconomical, I have met with on the subject of agri-

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In my letter in which I offered the present of the young ram, I mentioned, as an inducement to attention to the breed, that any sum not exceeding 200 dollars; could have been had for the ram I sent to Lancaster county; and that for young ram lambs, half and three quarters blooded from 12 to 20 dollars, could be obtained. I hoped expectation of profit would induce care; and excite emulation. But it had the effect of repulsion and refusal; under the idea that some such charges would be made. This shews that it requires address to prevail on some of our people, to receive benefits. I am happy to declare, that this is the only instance of such unworthy misapprehension, I met with. It is here noticed, not because I deem it important, as it relates to myself; but to impress the necessity of taking some measures, if any are practicable, to promote a general disposition among our agricultural citizens, to improve the breeds of every species of animals, comprising the stock on their farms.

culture. There was, some years ago, and, unless the troubles in *Germany* have distracted this valuable institution, there may yet be, a society at *Leipsick* whose labours would enrich our country with much valuable information; were translations made of their essays and communications, on a great variety of agricultural subjects. Among them will be seen, some excellent accounts of the *gypsum;* by which it will appear, that its uses in agriculture had been long known in that country, and that it was there held in high estimation. The varieties of opinion, and the prejudices entertained here, are similar to those existing, and ably refuted in *Germany.*

Two respectable farmers who live on and near the tide waters of the *Delaware*, in this state, have recently informed me, that the *gypsum* has ceased to benefit their lands; though it had at first been highly serviceable.—On enquiry I find this misfortune to be singular, even in the quarter in which they reside. Their situations are peculiarly exposed to bleak easterly winds, which blow over their fields damp vapours: and overload the operative part of the *plaister.* Possibly water is to be found at small depths, from the surface of their lands. It is a property of the *sulphuric acid* to attract water. Chymists discover this in their laboratories, farmers perceive it in their plaistered fields; which retain moisture, long after it has evaporated from other grounds. *In combustion*, the *sulphuric acid* parts with its *oxygen*, and retains *hydrogene;* and there may be some process in nature, which operates, in some situations, similar effects. We know that air impregnated with marine salt, neutralizes or

decomposes the plaister; and any undue admixture of other acids or the *gasses*, though no salt air may exist, may destroy its agricultural uses. It is so with the soil; which, to be productive, must have a due proportion of the parts administering to its fertility. Lands become *lime-sick*, as it is called, after much of that manure has been applied, for a great length of time. They recover, so as to admit of new applications of it, after intermission and proper culture, with vegetable or animal manures, ploughed in.

It is not strange, that, on the first appearance of the *plaister*, with bad properties ascribed to it, people should have been incredulous. The prejudices and want of faith should have ceased, when experiment had verified facts, in proof of its qualities. But both incredulity and prejudice continued, for a great length of time.—Circumstances not uncommon, being too often the attendants on the first introduction of all improvements; however important and salutary. It was called *conjuring powder*, *magical dust*, &c. &c. by those who amused themselves, with the supposed folly of the advocates for its efficacy and usefulness.

Among its uses, I have lately been informed of one, I had not before discovered. It has been given to horses for the cure of the *heaves;* which is a *cough* and *asthma*, the precursors of broken wind. Having an horse afflicted with this complaint, I followed, without prejudice for, or against them, the directions of my informant. A small handful of ground plaister is to be given in the feed, four or five successive mornings; when it will operate as a strong purgative. The dose is to be re

peated, after a few days. The horse will refuse the second course, if he be not starved into compliance. I find it to be a violent *cathartick*, if taken in sufficient quantity. In the "*Agricultural Enquiries on Plaister*," page 85, in a note,—the formation of *calculi*, in the *viscera* of horses, is mentioned; as having been by some farmers attributed to their taking in *plaister*, mixed accidentally with their food. I did not then know the purgative quality of the *plaister*. It refutes every idea that it would remain in the *viscera*, long enough to form *concretions*.

The doses of pulverized *plaister*, gave my horse some temporary relief. But I have no faith in any remedy proposed for this incurable malady. I have seen a fact published of an horse at pasture cured by drinking, during a whole season, *pond water*, *impregnated with lime*. But we do not hear of this horse, after being, for any length of time, on *dry food*. I have known *lulls*, in this disease, procured by various palliatives; but it returned, after exercise and hard work, or dry food. *Diet* is the best palliative, but *hay* is bad; the food should be wet and laxative; and some gentle aperient should be often used. *Garlic*, *flaxseed*, *sulphur*, *tar*, and *lime water* &c. I have, in vain, administered with *exemplary patience*. All are useful, but none effectual. Horses fed entirely (through the winters) on *potatoes*, have been relieved, for several years, though afflicted with *heaves*, or *broken wind*.

The *salivary defluxions* from horses, and horned cattle, and *hoving*, are unjustly attributed to plaistered grass. These I remember from my earliest youth, be-

fore the *gypsum* was used or known, as to its qualities applicable to husbandry. They occur now, in marshes, and other places, where no plaister is strewed. *Fogg* or *after-math*, and *second crop hay*, always produce these *salivations*, in a greater or less degree; particularly in wet seasons. Unmixed clover hay, especially where the crop was luxuriant, and not salted, always disagree with horses if exclusively fed. *Hoving* is common in *Europe*, in countries wherein the plaister is unknown, or not used in agriculture.

The defluxions produced on horses by the above mentioned causes, afford temporary relief in complaints of *heaves* or *broken wind*. This indication of nature might be improved upon, for the discovery of some palliative, or if practicable, a remedy, for this obstinate disease. *Bleeding* is useful, but has no permanent efficacy. It is probable that a course of *calomel*, in an early stage of these complaints, would either cure or palliate.

If any apology for this communication to the society, be necessary; it must be found in my persuasion, that it is incumbent on persons who have been in long habits of strewing the *gypsum*, to give information of their experience. Whatever may be its disadvantages, may now be pointed out, by those who have felt them. My obligations to it, invite and justify the opinion, that it will continue to afford important advantages to the community, as it has, for a long course of time, been personally beneficial to me. I presumed too, that it would gratify curiosity, to be informed of the humble and confined beginnings, from whence this extensive amelioration in husbandry originated, in this

country. From its cradle, it has had my assistance, to foster and rear it.—Now, it is of full age: and has gained strength and solidity of character, sufficient to support itself. Knowing exactly its origin, and the prejudices attending its infancy, I see with some surprize, but more satisfaction, the state of perfection and maturity, to which it has grown up. So that it is *now*, not only an important branch of commerce and manufacture; but a general, and essential requisite in agriculture.

Additional Observations on Plaister of Paris.

In exhausting this subject so far as my imperfect stock of information or conjecture enables me, I fear I shall exhaust also the patience of the society unprofitably.

I have been frequently asked "*what quantity of plaister an acre of ground requires?*" No precise answer can be given to this question. It depends on the quantum of substances in the earth, on which the component parts of the *gypsum* operate, or are by them operated upon. As these are in plenty or scarce, the effects are produced in a greater or less degree. And when they are exhausted, or where they do not exist, no quantity of *gypsum*, will produce agricultural benefits. If there be a greater quantity than is required to exhaust the subjects of its operation, the excess will remain an inert mass; inactive till new subjects call forth its powers.

The theory I long since mentioned, (with no small diffidence as to its chymical accuracy) has been uniformly useful, and practically efficient. Dr. *Priestley*,

I remember, objected at first to the *sulphuric acid* being the agent; because *gypsum* was insoluble, and the acid remained in combination. And of this opinion are some chymists, with whom I have lately conversed. But the Doctor finally told me, that by some process in nature (which I do not correctly recollect) it was set free; and was at liberty to perform its office. Nature provides means to effect her designs, superior to our artificial substitutes. It is incredible, that while the *gypsum* is performing astonishing operations, it should remain an inert, insoluble compound.

Much weight has been given by some, to the opinion that the calcareous matter of the plaister, is the principal cause of its utility. But this is a subject operated upon and not an actor:—a place of deposit for the acids. If it were otherwise, the small portion of it in the plaister, applied to a large surface, would not practically justify the conclusion. I know by experience, that it requires, of calcareous substances alone, a very great quantity indeed, to produce important effects on vegetation. But the oil of vitriol, without calcareous matter, will operate powerfully. The *pyrites* have no calcareous matter, being compounded of metals and sulphur. And yet they operate on plants, by the vitriolic acid contained in them. For the burning the *pyrites* by the *Brabanters*, I cannot account. I have been informed, that "it is converted to a sulphat by moisture, and exposure to the atmosphere; and then becomes soluble by lime." But the combustion of plaister is not beneficial. I have often failed in the application of calcined plaister; and yet the chymists say, that it is not the *sulphuric acid*, but the water of chrys-

tallization, which escapes in combustion. *Vitriolated tartar*, *glauber* and *epsom salts*, and all combinations of *sulphuric acid* promote vegetation. I believe, (though I do not exactly know the fact) that *gypsum* contains the greatest proportion of this acid, of any substance in which it is combined, and its cheapness gives it a preference in husbandry. In it there are 48 parts of the acid, and 34 of calcareous matter. It is not the only salt beneficial to vegetation. Those not having this acid in combination, produce useful effects. *Salt petre (nitrat of potash)* I have found highly beneficial, when *indian corn*, before planting, was steeped in a solution of this salt. All these salts are chymical compounds; and require greater or less powerful solvents, as well as *gypsum;* about which I start no difficulties. These solvents are furnished to them, in the laboratory of *nature* as well as to the plaister. It is not well ascertained that *common salt (muriat of soda)* is a manure.*

* It yet remains doubtful whether *common salt* is, or is not, a manure, in its crude state. I have sometimes thought well of it; and used it in every way. When mixed with putrescent or putrefiable substances, judiciously, it is best. In large quantities it prevents, though in small portions it promotes putrefaction; being *antiseptic* in one case, and *septic* in the other. An incautious mixture of either *salt* (common) or *lime*, with the *muck*, or *compost bed*, often defeats the object of their application. If *lime* be applied it consumes putrescent substances, and forms insoluble compounds which are inactive; and they compose the greatest proportion of the dung. *Lord Dundonald* decides against the use of salt, especially on poor land: he says that if it be at all useful, it is on rich land. He highly recommends *sea water* for its great

If it is, it acts by its *septic* quality, when applied in small quantities. It prevents the operation of plaister, by furnishing *soda* to the acid of the *gypsum;* and with it forming *sulphat of soda*, *(glauber salts.)* This is the cause of the plaister not operating on sea coasts. I have ruined a bushel of plaister by an handful of salt; which renders it unfit either for manure or cement.

It is of no farther consequence to the farmer to know the operative principle of the plaister, than as it directs his practical use of it. And whether it acts *per se* directly, or by the disengagement of other acids, by its means; when it expels them and takes their places, is immaterial; if the results are attended to. The *modus operandi* of manures, is a complicated and yet unsettled subject. It is highly probable at least, in theory, and practical results confirm it, that there is in the earth, assisted by the atmosphere and waters, some process, or resolvents, to set free this potent actor; either for its own operation, or to disengage other acids beneficial to vegetation. The laboratories of the chymists are incapable of establishing indisputably, or confuting satisfactorily, this position. The fields of the farmer exhibit agricultural facts, by which it has been sufficiently tested for his purposes. By these he is enabled to

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benefits in husbandry. It contains, in a ton, a bushel or a bushel and an half of *salt*. *Sea salt* is recommended for the destruction and putrefaction of *snails*, *slugs*, *grubs*, *worms* and *insects* infesting grounds. They abound the most in lands to which animal manures have been long applied. The vitriolic acid is equally efficacious; and I have therefore believed, they do not so much infest plaistered fields.

know, that when the earth is deprived of these solvents, subjects of affinity, or by whatever name they may be called, he must supply them artificially. He will find, as I believe, this conclusion agriculturally right, whatever may be its chymical theory. The opinions of *chymists* I highly respect, *on any chymical topic. Unumquisque in sua arte peritus.* They have in many important instances, highly served the interests of agriculture; between which and chymistry, there is an intimate and all important connection. It is to be wished, that more chymists were also farmers, and the soil their laboratories. The whole earth, in connection with its atmosphere, is the grand laboratory of nature. All that it contains, produces and supports, acting and acted upon, distinctly or in combination, bring forth effects by chymical processes, essential to their mutual existence. But the matter and the manner, are to us more subjects for conjecture, than of accurate knowledge. We must therefore depend the most, on practical facts.

Lord Dundonald in his "*Treatise on the connection of agriculture with chymistry*" (Lond. Ed. 55-6-7-8) has given an account of the *vitriolic acid*, and its operation and effects, as they relate to agriculture. Some persons of chymical information, are not satisfied with all his theory. But I believe his book is generally allowed to have great merit. One part of his account of this acid, he applies to the use of plaister in *America*. In it he observes what we know by experience in its result. "Still the *gypsum* remaining in the soil would, on a renewed application of *dung*, *animal* or *vegetable matter*, be brought from the state of *gypsum*, which is insoluble, to a state approaching to that of *hepar of lime*,

which is soluble." The effects of this re-application of *dung*, &c. we have often experienced; and let chymists judge of the *modus operandi.* This book should be read by all farmers desirous of gaining valuable information. That new applications of plaister, with animal and vegetable substances, will again operate, has been frequently and universally proved. But I met with an instance to shew that *gypsum* lying in the earth for years, will again operate, with such re-applications of subjects. It also confirms my assertion, in the outset, that if too much is applied, only the necessary quantity is operative. Many years ago, I gave an account of my having used plaister, after it had remained five or six years, on old indian corn hills, whereon too great a quantity had been injudiciously and unnecessarily lavished by a tenant. It operated again where dung was applied, though I thought not so vigorously as that recently obtained. The excess of that applied too profusely, beyond what was required by the substances in the earth, remained in its original state of composition.

The author of nature (as Lord D. observes) has thus wisely directed, that *acids*, *salts*, and such volatile, fugacious and soluble parts of the system, should have an affinity for, or tendency to form a chymical union with stationary and more solid substances; that they may be detained in the earth for the purposes designed by their creator, and be ready again to act, when their agencies are again demanded. If this were not the case, they would escape, or be washed away in the waters of the earth or the ocean; and thus pollute and poison one part of the creation, while they left the other barren, and

incapable of producing or supporting vegetable supplies, or animal existence.

It is not surprising, that chymical pursuits should fascinate enquiring minds. They open the great, and often hidden springs of operation, by which the purposes of the creator are effected. So far are they from encouraging the wild and flagitious speculations of sceptics, that they teach us, with humble adoration, and ardent gratitude, to

"*Look through Nature up to Nature's God.*"

Account of the Dimensions of American Trees.
By John Pearson.

Read October 13th, 1807.

Darby, August 28th, 1807.

Respected Friend,

Agreeably to thy request, I do myself the pleasure of informing thee of the large forest trees &c. of which I have read, or had information respecting, from persons of apparent veracity. I have generally noted the books, or the name of the authorities in my notes.

In Georgia, many black oak trees are 8, 9, 10, or 11 feet diameter, 5 feet above the surface, we measured several above 30 feet girt, perfectly straight 40 or 50 feet to the limbs. The trunks of the live oaks are generally (says the same writer) from 12 to 18 feet in girt, and sometimes 18 or 20, some branches extend 50 paces from the trunk on a straight line. Cypress are found from 10 to 12 feet diameter, 40 to 50 feet to the limbs.

In 1791 a yellow poplar grew on the lands of Charles Hillyard Kent County Delaware, 36 feet in circumference, appeared sound, and very tall.

M'Kenzie says that in latitude 52° 23′ 43″ north, are cedars 24 feet in girt, and that canoes made of them carry from 8 to 50 persons, and that an alder was 7 1-2 feet in circumference and 40 feet without a branch.

In 1785 about 2 miles from Morgan town Virginia, a walnut tree was 19 feet round, retaining its thickness well to the forks or about 60 feet. In Harrison county same State, and year, a poplar tree was 21 and 1-2 feet

round, 5 feet from the ground, and supposed 60 feet to the branches. A vine was seen by my informant, at the same time, which he supposed was more than 2 feet in diameter; his idea then was, that he could not have shouldered a piece of it 4 feet long, though he was able to shoulder 4 1-2 bushels of wheat, when standing in a bushel.

In Lycoming county, Penn. the sugar maple tree is found 4 feet in diameter: a cherry 5 feet from the ground, 14 feet 4 inches round, and carries its thickness well near 60 feet to the branches. A white oak 3 feet from the ground, 15 feet round, and one which was felled, was 4 feet diameter, and 70 feet without a limb; the limbs were 2 feet 6 inches in diameter.

In Evesham, Burlington county New Jersey, grew 3 white oak trees, the stump of one of them was 11 feet 3 inches in diameter, and 59 feet to the forks; from it were made, and sold in Philadelphia 40,000 merchantable barrel staves; it was 300 years old: one of the others 4 feet 6 inches from the ground, was upwards of 27 feet in circumference, and 60 feet to the first fork; the other at the same height from the ground, was upwards of 24 feet round; the first mentioned tree was said to be perfectly sound in the heart.

In November 1791, a hollow button wood or sycamore, on the south east side of the Ohio, and about 15 miles from Pittsburgh, at 4 feet high from the ground, was 39 feet round.

Either a chesnut or poplar, near Peach Bottom ferry on the Susquehanna, was hollow, and was 11 feet in diameter within, a school was said to have been kept in it.

A white oak tree 4 feet in diameter, was felled in Cumberland county Pennsylvania, which was about 700 years old.

On Sandy Lick creek in Pennsylvania, a pine tree was 12 feet in diameter, and at 12 feet from the ground, divided into branches: on the south branch of Potowmack a sycamore tree was 9 feet in diameter.

On the dividing ridge which separates the waters of the Pymatung, or Shenango, from those which fall into the Lake Erie, in Pennsylvania, grew a white oak, which at 4 feet from the ground, was 24 feet round, about 40 feet to the first branches: a spanish oak of about an equal size: a chesnut at 3 feet from the ground, was upwards of 24 feet round. A poplar 28 feet 4 inches; and a white pine about the same size; my informant could not recollect the particular spot on which the two last mentioned grew.

A wild cherry was said to grow either on the western waters, or those of Susquehanna, (my informant could not ascertain which) by a person viewing, and competent to judge, was supposed large enough to make 10,000 feet inch boards, exclusive of several large limbs which would cut good saw logs.

A white pine grew on the Hudson or North River, 24 feet 6 inches to the limbs, and 5 feet in diameter.

A white pine was said to stand near Le Bœuf (Waterford) Pennsylvania, 30 feet in circumference.

In Wayne county Pennsylvania, are white oaks, white ash, and cherry trees, 5 feet in diameter, from 50 to 80 feet in length; white pine nearly 7 feet in diameter; *all* almost clear of knots or limbs.

A black walnut near the Muskingum, State of Ohio, at 5 feet from the ground was 22 feet in circumference, and a sycamore near the same place, at the same distance from the ground measured 44 feet round.

In Crawford county Pennsylvania, grew a hemlock* 26 feet round; and a poplar 25 feet, thrifty and likely to grow many years; a chesnut in Erie county 30 feet round.

A poplar† in Adams county Pennsylvania, Hamiltonban township, 36 feet round, 30 or 40 feet to the forks, has a great top, and appears perfectly sound.

In Brush valley near the line of Northumberland and Centre counties, grew a walnut tree 22 feet round; the body straight for about 25 feet to the forks, they were about 18 feet in length to the commencement of the branches; appeared perfectly sound; within about 4 perches of it, was another 4 feet in diameter, 45 feet to the branches, and perfectly straight.

A sycamore on Harris's Island in the river Juniata, Pennsylvania, at 3 feet from the ground, was 27 feet 9 inches round, about 5 feet from the ground it divided into 4 forks, one of which was 15 feet 9 inches, one 10 feet 6 inches, one 8 feet 6 inches, and one 8 feet in circumference. A tree of the same kind near the former is 17 feet round, both very high, apparently sound, and very thrifty.

In Springfield, Delaware county, Pennsylvania, is a sycamore which in 1803 was 19 feet 6 round, very thriving, the body short, branches extensive, stands on

* Pinus Abies Americana. † Liriodendron Tulipifera. Lin.

high stony land, is apparently sound, and will probably become a great tree.

On an island in the Ohio, 13 miles above Marietta, grew a tree, the stump of which was standing in 1798, 12 or 15 feet high and hollow; the circumference was about 60 feet, the shell 2 or 3 inches thick, diameter inside upwards of 18 feet.

An apple tree is now (1807) growing in Upper Darby Delaware county, Pennsylvania, which I measured in 1803, and found it 10 feet 4 inches in circumference, sound, branches thrifty and top large.

In Ridley in the same county, a red oak was cut in 1795, 6 feet in diameter was then very thriving.

A friend of mine caused a white pine to be felled in Luzerne county Pennsylvania, which was only 14 inches diameter, but 120 feet to the first branch; the remainder was 12 feet long.

A chesnut sapling in Chester county Pennsylvania, made nine rail cuts of 11 feet each, the butt cut, made 10 rails, the last cut made one.

In relieving the garrison of Oswego, (I believe in the war of 1755) came in one birch canoe 45 feet in length, and 7 in breadth.

A poplar grew near the Virginia head of Roanoke river, 39 feet round, 4 feet from the ground, apparently sound and about 40 feet to the forks: my informant crossed a river in Maryland in a canoe or scow made of a linn tree,* in it were 7 men and 4 horses, and he supposed it would have carried double the number.

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* *Tilia Americana Lin.*

In lower Chichester, Delaware county Pennsylvania, a black oak tree was felled in 1790, which was 8 feet in diameter.

A Sycamore tree stands in the town of Jefferson, Cayuga county, state of New York which is 47 1-2 feet in circumference, hollow, but improved by art, having one side open as a door, and is green and thrifty.*

In the spring of 1807, a hickory tree on the banks of the Ohio, 2 miles below the mouth of Kentucky river, measured 16 feet 8 inches in circumference, very lofty, kept its thickness well: at same time an ash on the east bank of the Mississippi 17 feet round, very tall; several near to it 12 feet and upwards round.

In Vermont a white pine 6 feet in diameter 247 feet in height, it was there considered as a large tree; they are there said to live the longest of the forest trees, being from 350 to 400 years old.

A white pine was cut at Dunstable, New Hampshire in 1736, 7 feet 8 inches in diameter.

In 1803, a person told me he saw a white walnut tree near lake Erie, only 7 and 1-2 inches in diameter, and 63 and 1-2 feet to the first branch.

In the same year I measured a white oak tree in Allegheny county Pennsylvania, 15 feet 6 inches round. A sycamore on the bank of the Ohio 33 feet round, and sound; a sugar maple near to it 15 feet round; a walnut tree near Big Beaver west of Ohio, 18 feet 6 inches round, 45 feet to the branches: a sycamore 19 feet 6 inches round; a thorn tree in Mercer county Pennsylvania, 5 feet round; a white oak tree near the falls of

* *Med. Repository Hexade* 2, *vol.* 4.

Big Beaver, Beaver county 18 feet 6 inches round, 60 feet without a limb, and there, 4 feet in diameter. A spanish oak on the east side of the Ohio, a few miles from the river, 29 feet 6 inches round; at John Hunter's in Newton township, Delaware county Pennsylvania, is a chesnut tree 27 feet in circumference.

I am informed that a walnut tree in Genessee, State of New York, was 21 feet round, and that a sugar maple on the banks of the Mahonning, Mercer county Pennsylvania, was 16 feet 8 inches round: that a poplar between the Shenango and Neshannoch, was 21 feet round.

The foregoing contains an account of the principal part of the large trees I have been able to collect on the continent of America.

I am with respect, thy friend,

JOHN PEARSON.

DR. JAMES MEASE.

P. S. To the above interesting account, the following facts may be added.

On the farm of Israel Morris, lying on the division line between Montgomery county and Blockley township, Philadelphia county, I measured a chesnut tree, 17 feet 6 inches in circumference.

On the farm of J. B. Smith Esq. in New Jersey, a poplar tree is growing, thirty three feet in circumference.

A cypress tree, near the village of Coosawhatchie, Beaufort district, South Carolina, grew a few years since, which was 42 feet round: 17 men dined inside of it, round a table.—*Dr. Drayton of South Carolina.*

J. M.

On Peach Trees.

Read December 8th, 1807.

Belmont, November 17*th*, 1807.

Sir,

I wished to have all the intelligence on the subject of the *peach tree* fully communicated to the society; and, for that purpose, I wrote to some friends, who had it in their power to assist my views. I send a letter from Dr. *Tilton*, who adds to professional talents, much information upon horticulture, and rural affairs. I am obliged by the Doctor's ready and useful compliance with my request. I had suggested to him a conjecture, that this tree has a predilection for some favourite climate and temperature, in which it thrives as an indigenous plant. I thought that like cotton, indigo, rice, and trees, and shrubs of various kinds, the peach was natural in some regions of our country, and forced in others.—Although the Doctor does not seem thoroughly of that opinion, he gives an instance of the *early peach*, which came to maturity in *Northampton* in the eastern shore of *Virginia*, in June; and did not ripen at *Wilmington* in *Delaware*, till September. This would seem to confirm my idea, that this tree delights and thrives best, in a climate more southerly and temperate than ours: and I endeavoured to find out a line of demarcation. It is one thing to cultivate, under forbidding circumstances, for pleasure and curiosity; and another, to apply our labours and resources to extensive, appropriate, and profitable products. Whatever be the causes of failure, this tree requires, in this quarter, more care and atten-

tion than suit the common farmer; and it appears not likely to become an object here on any great scale. I still think, that the disease, so generally fatal (more so this year, than any other in my memory) called the *yellows*, is *atmospherical*. *Insects*, certainly, are the causes of many injuries and diseases; but they are most frequently seen in morbid parts, feculent or putrefying from previous malady; and are effects, rather than causes. I have always considered *mildews* and *blights*, as originating in atmospherical taint: yet Sir *Joseph Banks* asserts, that parasitical *fungi*, and others affirm that *insects*, are their causes. I believe, with much deference to authorities so respectable, that the *fungi* originate, and the insects breed, in the morbid juices and extravasated sap, after the plant has become sickly: and I think this to be an opinion most generally received, both as to plants and trees. It is well to guard against both, without taking either opinion for granted.

I received verbally from a wealthy farmer (Mr. *Bellah)* who is the proprietor of a considerable landed estate in *Delaware*, the following account; which he says is generally applicable to the culture of *peach trees*, in the southern country.

"In *Kent* county *Delaware*, they cultivate the *peach tree* without any difficulty or risk. Although the common mode is to plant the young trees grown from the stone, without budding, or engrafting, yet some crack the stones and so plant them; others take out the kernels, and plant them with their corn; dropping two (to ensure *one)* in a hill, at about twenty-five feet apart, in squares. They tend the corn field in the usual way; and the young trees grow with the crop, to the height

of three or four feet, in one season. Large orchards are thus obtained, at a small expence. The knife is never applied to the standard trees (except that some head them down *once* when young) it being found injurious, and to occasion the limbs of pruned trees heavily loaded, to break off. When suffered to grow at pleasure, they are multiplied, flexible, and tough; and lay on the ground unhurt. The crops are certain, abundant, and well flavoured. In size, they are little inferior to those on pruned trees; although the sizes on the same tree, vary much. Trespasses by cattle are sometimes committed; but the trees browzed or torn, recover the next season, the orchards being generally enclosed; to exclude horses or horned cattle. They obtain fruit in three years in plenty; and the trees have been known to endure fifty years. No worms or diseases assail them. They are so easily propagated, and renewed, that cutting down a peach orchard for a course of tillage, on ground ameliorated by standing many years, occupied as an orchard, is not uncommon. The limbs are often so loaded, that the weight prostrates them; and they lay on the ground securely. None break that are not pruned, and they recover their usual position, when the fruit is detached. There are orchards of fifty and seventy acres; and some larger in *Accomac* and other parts of the isthmus between the bays of *Chesapeake* and *Delaware*, further south. The more sandy the soil, the better the fruit; nor should it be over-rich. Peach orchards are planted, to ameliorate worn lands; and hogs are at certain periods of the season turned in, to feed and root at pleasure. Perhaps insects and vermin are destroyed by them; and they benefit the soil,

and by turning and loosening the surface, forward the growth and health of the trees. *Apple-trees* do not thrive, in the soil favourable to the culture of the peach."

Compare this account, with the actual state of the *peach tree*, in our country, and judge whether we live in a region favourable to its growth. Mr. *Heston's* attempt at cultivating this tree, in the southern manner, begins already to fail. His trees are evidently infected; and many are on the decline. The *yellows* are universally prevalent, this season, throughout the whole country. I do not wish to discourage perseverance, in the culture of this tree. But, when particular products often fail, they warn us to apply our main strength and resources, to other objects, more certain and equally profitable. Let hazardous cultivation, be collateral and subordinate.

The *mercury*, as mentioned by Dr. *Tilton*, for the cure of the disease in peach trees, I have frequently applied to *plumbs*. I bored a gimblet hole through the bark, and about half an inch into the *alburnum*, or sap wood, and inserted a drop or two of crude mercury, so as to be carried through the circulation, with intent to destroy vermin or insects in the bark or fruit. I have sometimes had plenteous crops, apparently from this remedy; but I have more frequently been disappointed.

I am, Sir,

Your obedient servant,

RICHARD PETERS.

DR. JAMES MEASE,

Secretary Agric. Soc. Philad.

Bellevue (near Wilmington, Del.) Nov. 6th, 1807.

Dear Sir,

Your letter of the 3d ult. came to hand at the moment I was setting off on a journey to Talbot county in Maryland; and your second letter of the 6th was received on my return. I shall pursue the order recommended in your second letter, by giving you the best history in my power of the peach tree; with such observations as I may deem of any importance in its culture, diseases, &c. And if it shall contribute any thing to your more perfect history, I shall be very glad.

Miller says the peach tree was brought into Europe from Persia, whence it derives its name. There is good reason to believe it is a native of those parts of South America, where it grows wild, like other forest trees. I do not think the success of this tree depends upon any line of demarkation between north and south. I never saw peaches grow in greater perfection, than on governor Livingston's farm near Elizabeth-town.—Noah Webster gives direction for the cultivation of the peach tree, in Connecticut, and particularly recommends the propagation of early peaches. I have been informed this fruit is matured in great perfection in Massachusetts; but how much farther eastward it is capable of maturity, in open ground, I am not informed. M'Mahon, in his gardening, takes notice that the peach tree, in Europe, grows as far north as the grape-vine, but alledges, that in northern climates, the peach requires more assistance from art, to bring it to maturity, than the grape. But although the peach is capable of great perfection in high latitudes, it must be confessed, that southern and warm districts are most fa-

vourable to its production. A fine early peach which ripened, in Northampton, Virginia, so early as June, did not ripen on my farm, before the last of August and first of September. The sandy soil of our southern states, appears to be more favourable to this fine fruit, than the stiff clay of our mountains. But nothing appears to me to have more influence, in the successful production of peaches, than a near approach to water. All the information I have received convinces me, that not only the coast of the Atlantic, but the borders of our western waters are more favourable to the production of peaches, than districts more inland. It is said that peaches grow in the greatest perfection, and even wild, on the river la Plata; how much farther south, I am uninformed; but probably the same rules govern in ascending the southern latitudes, as on the north of the equator.

I shall say but little on the cultivation of this useful tree; but will barely remark, that it should always be planted shallow, with the soil raised about it in the form of a hill; that Forsyth's method of heading down trees, a year or two after planting, insures the most vigorous growth; and that tilling the ground, for some years, after setting them out in orchards, is essential to the rapid and successful growth of the trees.

The diseases and early death of our peach trees is a fertile source of observation, far from being exhausted. In reasoning on this subject, as in the case of animals, we must ascertain the cause, before we can apply the most successful remedies. In all diseases of the peach tree, that I have examined, it appears to me that insects do the mischief. The curling of the leaf, the boring

of the bark, the destruction of the root and puncture of the fruit, all proceed from insects: and even that sickly appearance of the tree, called the yellows, attended by numerous weakly shoots on the limbs generally, is attributed to insects, by a late writer in our news papers.

A little beetle, called curculio, about the size of a pea bug, is the insect which punctures the fruit, and occasions it to fall off or rot, before it comes to maturity. I have been so tormented by this insect, as to be at great pains to investigate it. You may see the result of my enquiries, in Dr. Mease's edition of the Domestic Encyclopædia, under the head "Fruits."

The wasp-like insect which bores the bark of the tree, and delights especially in that region just below the surface of the earth, I am not so well acquainted with, but do not believe it so important in its mischief as the curculio.

But besides this large wasp-like worm, which you always find solitary under the bark, there are millions of little grubs or maggots, that appear in great clusters, round the roots of the trees. Some naturalists have supposed these are of the same kind as the large worm, only in the infant state; but I am strongly inclined to be of a different opinion: for their number is above all proportion to that of the large worm; and they are as uniform in size as the large worm, so as to manifest nothing like growth or progress towards greater maturity. It deserves consideration, whether or not these small worms are the curculiones, in the maggot or grub state. Their numbers, as well as the natural history of the beetle order, would seem to indicate this. I have observed too, that in the districts of our country, viz.

between Trenton ferry and Christiana creek, where the fruit is most injured by the curculio, there also the mortal distempers of our peach trees are most prevalent. My acquaintance with natural history, however, is so limited, that I can only suggest the hint, and express my wish, at the same time, that you, who have it so much in your power, may pursue the enquiry, by the assistance of persons at your elbow, altogether qualified for the task. Professor Barton would probably render you his assistance cheerfully. Or if he should be too much occupied, there are in your city, other men, and all the books requisite for the enterprize. If the natural history of these insects were once well ascertained, we might then combat them to great advantage.

The best means of combating the curculio, are suggested in the Encyclopædia before mentioned.—For destroying the worms at the root of the tree, the best method I have ever employed, is to draw the dirt from the root of the tree, in the fall, and pour boiling water on the roots. In the spring, my practice is, to return the soil to the tree, in the form of a hill. By means of this sort, a tree may be preserved many years.

I have seen two measures proposed, in our news papers, for curing the yellows in particular, and for destroying insects generally. One is that of boring a hole in the tree, filling it with mercurial ointment *(unguentum cœruleum)* and corking it up. The other is by boring a hole on the north side of the tree, filling it with spirits of turpentine and corking it up. Both authors assert, that their respective specific kills and disperses every kind of insect from the tree thus treated. I have not yet employed either; but I am so well persuaded of

their noxious influence, on insects generally, that I am determined to make trial of them. I will not take up your time with any account of the little insects which curl the leaves of peach trees. They have always appeared to me so unimportant, in comparison with those before described, that I have paid very little attention to them.

In my jaunt through Maryland, I was attentive to the subject of your letters. I found the peach trees generally were long lived, healthy and bore well. In Edward Loyd's garden, I observed some of these trees fifteen or eighteen inches diameter, and perfectly healthy. Col. Nicols, near Easton, abounds in the best kind of peaches. He is an old residenter, and particularly attentive to fruits. I shewed him your letter and enquired for information. He told me he had read my dissertation on the curculio, and could vouch for the salutary effects of hogs running at liberty among fruit trees, particularly the peach, apricot, &c. He also gave me a *receipt*, which he said, he had practised on peach trees with advantage to their health, and which I now transcribe in his own words. "Take away the dirt from around the roots, and where you discover gum issuing out, you will also find a white maggot, which is carefully to be taken away, then wash the body and roots with strong brine, which you will repeat now and then in the spring and summer." In the course of conversation, he remarked on the noxious influence of salt, *(sal. marin.)* upon insects generally: and observed, that by tying a small bag of salt round the body of a tree, no insect would crawl up it. He said he had practised

this method on willows particularly, and never failed to free them from those crawling tribes, to which they are so liable.

Nothing else occurs to me on the subject of your letters. I wish you great success in your investigation; and shall be glad to know when your volume is published.

With great respect, I am,

Dear Sir, your friend

and humble Servant.

JAMES TILTON.

RICHARD PETERS ESQ.

Improvement of Land.

Read December 8th, 1807.

Chester county, November 20th, 1807.

Friend Vaughan,

Agreeably to your request, I now inform you how I have improved my farm. The first three years I could only keep two horses and two cows, and seldom had more than four tons of hay: though the last six years, I have grown from 20 to 25 tons a year. Had I taken your advice when I first took the farm, it would have thrown much in my way; that was, to use lime on my land.—When I determined to try it, I first got 200 bushels, and laid it on nine acres, planted with indian corn, and had as great a crop as had been ever seen growing: my neighbours came far and near to see it: the year after I made a fallow of the land, put in wheat on three acres, and the rest in rye, and had a good crop: in the spring, I sowed it with clover and timothy, and put two bushels of plaister of Paris on an acre, and had as great a crop of clover as could grow; it laid three weeks before the time of mowing; the lime and plaister did all this, for no land could be poorer before: there are ten acres in the field, and not being used to spread lime, I laid it on nine acres; where I laid no lime I got no clover, although I put on the plaister. I have limed all my land, and plaistered it every year and never fail of clover. I think two bushels of plaister are enough on one acre. In one field I have put on four bushels on half, and two on the other half and I find it no difference in the produce. There is ano-

ther thing in which I was wrong in not taking your advice, viz. not keeping oxen instead of horses: this spring all my horses became sick, and I was forced to buy a pair of oxen. I supposed I should be tired of them, but on the contrary I am tired of horses, as I find that with my two oxen, I can do more work, than I could with four horses, and with half the expence. I have worked horses for forty years, and if I had used oxen in their place, they would have put 500 pounds in my pocket. My oxen go to the lime kiln once a week, twenty one miles in the morning, and return the next day in the forenoon; after resting two hours, they go to work, horses cannot do this. There is another thing I find advantage in, I cut all my corn stalks and carry them to the barn yard for litter, when well trodden, I cover them with lime, and then add another layer, then more lime, and so on until all the stalks are used. In the spring, the stalks are all rotted, and I have no trouble in turning them up; last spring I had 176 loads of dung: the first three years if I had 20 or 25 loads, it was a great thing. My neighbours thought me crazy to buy lime, and to be at such expence, but now they are all falling into the same way.

I plough all my land in the autumn for corn, and in the spring lay on the lime, plough it all over, harrow it down and never am troubled with cut worms or weeds, I find the fall ploughing is a great advantage.

your affectionate friend,

WILLIAM ASHFORD.

JOHN VAUGHAN,
Member Agric. Soc. Philad.

The foregoing letter is published, for the encouragement of those who live on worn and exhausted lands. Some persons thus situated have lately written to the society; some in the part of the country wherein Mr. A. lives, and most probably on the same kind of land. They alledged that they could not procure dung, that plaister would not operate, and that *lime* was too dear Let them follow the example of their *fellow countryman.* But the mixing of *lime* while the vegetable substances are putrefying, is a mistake. It had better be put on the land; or if it must be mingled with the manure, let it be after the fermentation is over. The desponding correspondents of the society, were advised to adopt the following epitome of good husbandry. Some of Mr. A's corn stalks might have been cut by a machine now much used, and given to the stock.

The advice given to these farmers of worn land, is familiar to every careful husbandman.

1. If no water be in your barn yard---dig a well; and confine your stock from November to May: never permitting them to wander after water, or the provender of the stalk field, or miserable fogg of the fields, in which they empty themselves and scatter their dung, instead of filling themselves either for profit or œconomy. Let not a hoof unnecessarily leave your yard.

2. Haul into the yard, every putrescible substance you can get; and when proper, clean up the yard, and have *a pen* for your manure, both from the yard and stables, inaccessible to cattle or horses; whose poaching or treading prevents fermentation, and is highly injurious Mix *earth* with your litter, rather than *lime.*

3 Plough your fields in the fall, seven inches deep. But plough no more than you can manure; and let the rest lie waste, till you can do it justice. Buy *lime*:---if you cannot reach two acres, be content with one. Move your fences, and plough up their sites Mix leaves, weeds and all putrefiable substances, in long and low beds; so as to be turned by the plough, and become excellent compost. For this purpose also, go into your woods, and, with leaves and wood soil, make beds of compost of these materials, as well as of the mould in low places, into which it has washed, or has been deposited by ponds of water, or rains and floods.

4. Lime your fall ploughed fallow with forty bushels to the acre. Plant indian corn; put *compost* on the hills, and *plaister* the corn.

5. After the corn is gathered; cut your stalks, and haul them to your yard. Plough again for a winter fallow. Your ploughing (except for seed) should never be less than five to seven inches deep.

6. In the spring harrow in *buckwheat*, to be rolled and ploughed in when in full blossom, with an East Jersey plough without a coulter, or any other, that will not choak.

7. Put on what dung you have made, and plough it in with your seed. Your compost will now be fit for top dressing your *wheat;* which is to be the crop of this year; and sow no more than you can manure.

8. On the wheat sow *clover* seed---and the succeeding spring---plaister the clover. All this can be accomplished in two or three years. When you have perfectly learned this alphabet, you will get into habits that will enable you to *teach*, instead of requiring instruction

9. When your old fields have inert vegetable matter (as is the case with most old fields) plaister them, to throw up pasture, and encrease your stock by this additional subsistence.

10. Never sow in a foul or weedy fallow, to save a ploughing; or on a wet one to save time. Avoid *oats* and exhausting crops---and never *stubble in*, or let one chaffy-husked, or culmiferous crop immediately follow another.

11 Change your crops, and destroy weeds; or they will destroy you. Turn a foe into a friend, by turning them into manure. Explore your own, and the neighbouring farms, for marle, clay, peat, earths, or substances for experiment on your fields. Be not discouraged by failure, but persist in essays, on a small scale, till you succeed.

Belmont, January 20th, 1808.

Sir,

Observing, among our communications, none on the subjects discussed in the one enclosed, I request you to lay it before the society. Our association consists of many, who are competent, by their talents and information, to add to the means of effectuating our objects. I risk much, in my endeavours to elicit from others, the assistance we want. It is due to myself, however otherwise unimportant, to declare, that it is the leading motive with me, to set an example, which others, whether in or out of the society, may follow, with more beneficial results. It was part of the terms, on which I accepted the honour of the society's chair, that I should receive the assistance of the members, who have it in their power to render it. Should I find myself disappointed, those we mean to serve, will suffer privations, which will add to my regret. The only consolation I shall experience, by bringing into the view of the society, a variety of subjects for others to improve upon, will be that of having attempted, however unsuccessfully, to keep my part of the engagement; to make every practicable effort, for the re-animation of an eminently useful and disinterested institution, which had become torpid by neglect.

I am, Sir,

Your very obedient Servant.

RICHARD PETERS.

DR. JAMES MEASE,
Secretary Agric. Soc. Philad.

On the Thickness, Cement, and Materials of Walls of Farm, and other Buildings. By Richard Peters.

Read March 8th, 1808.

Sometime ago, I took down a thick wall; and observed the interior rotten and friable, (crumbly) although it had been built 60 years. Had the mortar been properly composed; *time* would have rendered it perfectly solid. But I found that it had been overcharged with lime; and that sandy loam had been used, instead of pure sand. The masons of this day know better; but they waste lime, by mixing an undue proportion with their mortar, because it works more freely under the trowel; and thus, for their own ease, add to the expence of their employer. I consider walls to be *thick;* when they exceed 18 inches.

Thick walls, are not, in general, the strongest. A mistake of this kind was made, when the *Philadelphia prison* was erected. The interior cement was not indurated, for many years after the erection; owing to the thickness of the walls, in part; and also to a defect in the quality of the materials, and the composition of the cement. Whether the sand was obtained where the water of the *Delaware*, at certain seasons of long drought, is *brackish*, I know not. *Marine salt* is deposited, in such seasons, higher up the tide waters of large rivers, than is generally imagined. This may be ascertained by filtration and decomposition; and by the appearance of sea fish, at such periods, in places higher than those of their usual resort. I have known sea fish

(both scale and shell) caught in the cove at *Wiccacoa*, in dry seasons, and on the opposite shores: and sometimes much higher up the river. Whether or not, *marine salt* was mixed in the mortar of this building; it is always prejudicial to cement. The *muriatic acid* (one third of the composition of *marine salt*) forms, with calcareous matter, *muriat of lime*, which, being deliquescent, will not indurate. Its strong affinity for *water*, attracts and retains the humid vapour of the atmosphere: as I have mentioned, on some former occasion. In thick walls, the masons, if not watched, fill in rubble; and the offals of the stone, in the interior. Some of the latter are necessary in all walls; but an over quantity is highly injurious.

In 1779 or 80, there were, in the *Philadelphia prison*, 1000 British prisoners of war, at one time; and, in other years, great numbers. Escapes were perpetual; though the commissary of prisoners and the keeper were, without rigour, always on the alert. By the permission of the War Department, in which I then was, the keeper (*Elijah Weed*, a firm but humane character) walked out daily, with squads of the prisoners, to afford them air and exercise. Few or no escapes occurred in these excursions; they having been restrained by a point of honour; and additionally, because it had been announced that if escapes took place, the indulgence would be discontinued. When locked up, they were under no such honourable, or cautionary obligation. Having been frequently called to an attention to this subject, by the reports of the commissary; I had an examination made of the *souterrain* of the whole fabrick; and was surprized by the result. I found that the cells in the

ground story, were arched over with brick. The arches were either 9 or 14 inches thick; and a slight pine floor, was laid over the crowns of these arches. Through this, access was easy to the cavities; between the crowns and springs of the arches. The bricks could be worked loose, out of these flimzy arches, with a knife, or any pointed instrument; and access to the cellars afforded.*

The trap doors, or apertures in the floors of their apartments, made by the prisoners, were covered from view by blankets: and most commonly, by those *off fatigue*, lying over them. With common cord wood sticks, hardened by partial burning, the detachments of *sappers* and *miners*, under the floors, and in the cellars, worked loose the inner crust, or face, of the wall; pulled out with their hands, without the aid of tools, the interior materials, and displaced the external masonry. Thus passages for escapes were afforded, through a long period, before discovery: and the affair was conducted with generalship. So that only a few eloped at a time, lest a detection should blow up the scheme too suddenly. The last fugitive always closed

* The mortar of these arches was so overcharged with lime, that it could be crumbled to pieces by the fingers of several people who examined it. It is to be hoped, that time has cured this defect. The absorbent quality of brick, permits richer, and requires more fluent mortar; but this is often overdone. Contract builders think they stint the mortar, to save lime, when they involuntarily hit the right point. But they do not fill the joints; and injuriously save in quantity. They should be obliged by the contract, to *grout* the work.

the breach in the wall, on the outside. We put an end to these nocturnal sorties, by directing the barrack master, to cause a large trench to be dug along the walls, outside; and wharff logs to be laid therein, from the foundations, to the surface of the ground. This was effectual; though the masonry opposed a feeble barrier against the efforts of these involuntary tenants of this dreary mansion. This instance strongly proves the mistake I have mentioned, made by even intelligent builders. This goal was built by *Robert Smith*, and *John Palmer*. The one the most celebrated architect, and the other among the best masons and bricklayers, of that day. I do not recollect the thickness of the walls, but believe they exceed three feet, in the ground story. The stones in general were not sufficiently large, though many were so; the mortar was too rich, and the wall unnecessarily thick. Nor were there a sufficient number of *ashlars* of size, on the faces; or *headers*, running *through* the walls, transversely. To guard against such defects, the materials must be sound, and the stones reasonably large, for every part of thick walls. So much time has elapsed since the facts relating to the Philadelphia prison occurred, that the mortar has unquestionably indurated; and the building become competent to all its purposes.

The hardest stone is not the most eligible: softer stones, easier worked under the hammer, or chissel, and of clean grit, are by far the best, They indurate sufficiently in the air or sun, are tenacious of the cement, and absorb and conduct the damp vapour, instead of repelling it, as do hard stone, by which constant moisture is retained on the walls. When this moisture

cannot enter the stone, it is called, vulgarly and improperly, *sweating;* though it is occasioned by the texture being impervious, and not permitting the damp to enter. *Vaults* and *cellars*, to be dry, should be built with soft, and clean gritted stone. Hard stone are thought best, to withstand attempts at breaches in jails; and for forts, and other works requiring strength; or subject to forcible assaults. However true this may be to a certain point, the idea is generally extended too far. A soft, tough, curly stone, will not break nearly as easy under the sledge; or separate by means of the wedge, or gad. It will stand battering by cannon balls, far better than hard or flinty stone. It is the same with timber. Hard wood will soon be shattered, broken, riven and destroyed, by a battery of cannon: whereas the *palmetto*, and other such woods, being spongy and soft, defy the attacks of the heaviest balls. *Fort Moultrie*, in *South Carolina*, was during our revolutionary war, an incontrovertible proof. Hard stone *resists*, and is shocked and broken throughout. But the balls make holes in their passage through soft stone, or wood, very little larger than their diameters; if they do not bury themselves therein, which sometimes happens. This fact can be ascertained; and I have seen sundry proofs of it. Some spongy wood will nearly again close the perforation.

If *Anderson's* ideas be correct, the solidifying of *mortar* depends on the coating and crystallization of the lime, on the surface, and in the cavities, of every grain of *sand:* which he says, is the better, the more it is silicious and rough; and furnished with corners and protuberances, encreasing the surface. He prefers *river*

sand: and next to this *pit sand;* on these accounts. But pit sand is generally smoother, smaller and less angular; and more mixed with loam, or earth. *Sea sand* is more subject to these objections as to its form; if it were otherwise proper; and those who build near sea coasts, should use pit sand in preference; as it is rougher, and has no saline mixture. More lime, than will plentifully coat the surface, is worse than unnecessary; as it cannot crystallize beyond a certain point; and the extra quantity having no *sand*, or substance, around which it can crystallize, repels, or prevents, the approaches of the grains of coated sand; so as to obstruct their adhesion, and forming, by general crystallization, a solid mass. With a view to this theory, as it was warranted by experience, the *common mortar* of the masonry of the *Schuylkill bridge*, was composed of three parts sharp, clean, coarse sand, and one part lime. The sand was thrown into a bed of thin wash, of slacked lime, and agitated till every grain was coated; and then, additions of sand were made, till the proper consistency was acquired. The proportion was less than a bushel to the perch; though no very exact attention was paid to this circumstance. Even the interior mortar and grout, of the thickest walls and piers, so far as they could be examined, were found perfectly indurated; after being covered by water, for a few months only. *Rich mortar*, is therefore one cause of the loose texture of thick walls.

The sand, for the bridge masonry, was obtained, by water transportation, from *Peters's island*, high up the river, and far above all marshy and foul bottoms, or shores. Near 12000 cart loads of this sand were used. It had every quality recommended by *Anderson*, and

others who say, that the bodies around which the lime crystallizes, should be sound, and incapable of being crushed. On a comparison with some *Delaware* tide water sand, and some pit sand, its superiority was so striking, that the mason would use no other; after a fair and long trial of the qualities of this. It assisted the crystallization of the cement in a greater degree, and in less time, than any other sand, within reach of the work. It was pure, and free from any foreign mixture of loam or mud. All alloys of the latter kind, are injurious; because they are crushed, and cannot resist, but yield to, the pressure of crystallization. The place from which it was brought, ensured its being free from any saline particles. For *pointing*, it required no washing; being of itself sufficiently pure.

This specification is not given, as a character peculiar to this sand; compared with that material in similar situations. But it is mentioned, with a view to recommend to all who build where the best cement is essential, and river sand attainable, to procure it from the highest accessible parts of streams. The deposits of floods, in these places, are of pure silicious (flinty) matter, brought from pebbly and clean bottoms; with no mixtures, collected from foul and marshy shores, or muddy beds of rivers.

In *walls washed by the sea*, or streams; or made *to contain water:* in thick masonry of *fortifications*, *mills*, and other *water works*, *basons*, or other stone work, either constantly or occasionally wet, rich mortar should be invariably shunned. It is believed by many, that mortar, in thick walls or piers, only affords *a bed* for the stone; and never indurates. But this is known to be

otherwise; as has been observed in the instance (though it is not singular) of the stone work of the *Schuylkill bridge;* which will long afford, under our own view, facts, proofs and examples, for most of the operations, and component parts of strong and massive masonry. It has been the over richness of the mortar, that has suggested this mistaken opinion.* The cement will solidify, if properly composed, wherever there is *air:* and it is well known, that this subtile fluid pervades all matter. If it were not otherwise proved, as it often has been, both philosophically and experimentally; the instances of *toads* and *frogs*, found in perfect animation, in the midst of solid blocks of marble, and granite, would be sufficient. *Air* must be inhaled for respiration, and must exist (as it is essential to life) in the stone; and communicate with, and circulate through, the common atmosphere, so as to bring fresh supplies, and carry off the mephitic; or these animals, thus isolated, would soon perish; if they could begin their existence; though they are said to require a less portion of *air*, than others.† There is no recess so retired, as to es-

* A decided proof of this, is mentioned in one of the reports of the committee, who superintended the building of this bridge; in the account of the masonry intended for a pier; but abandoned, as to its use, in that capacity. See *Statistical Account.* Page 41.

† Like all reptiles and amphibious animals, they can live with less air, than is usually required by others; yet it does not follow that they can exist without it. Some have doubted their being furnished with the organs of respiration. But I have, while attending experiments with the *air pump*, seen them die in an *exhausted receiver.*

cape its penetration. It brings along with it, the ingredients of which it is usually composed; and crystallization is perfected in the interior lime, though more time be occupied in the process. But before all, the stone, in size and texture, being proportionately large and sound, constitutes the principal strength of any masonry, well and faithfully put together. Therefore a thinner wall of sound and large stone, is far preferable to one composed of small stone; however in thickness it may exceed. *Loriot's* theory of walls, has already become obsolete. *Time* indeed gives opportunity, in any walls, for the lime to recover its *fixable air;* and again to petrify. But in those whereon pressure is immediate, and strength at once required, *time* cannot be afforded.

Pise walls, composed entirely of common earth, plumb, and well packed, rammed and consolidated, are stronger and better, for ordinary purposes, than those of stone, indifferently built, and composed of inefficient materials. For some uses, they are as good as stone walls. It would be well to select, and publish for information, a concise account of this cheap and excellent mode of erecting walls. For most farm buildings they would be perfectly competent.—*See Johnson's Rural Œconomy, for an account of Pise walls.*

The great mistake made by *rough casters*, is that of using mortar over rich. I have experienced the folly of this practice; and know the advantages of its opposite. Where gravel, from which all other matter has been screened; and where that and small pebbles are dashed in; the mortar will bear more lime. Because the gravel and pebbles afford surfaces, around which the *extra* quantity of lime crystallizes. In the common

way, I have rough casting, free from any defects, composed of *five* parts sand (river sand from my island) and *one* of lime. The first coat should never have less than *four* parts sand, and *one* of lime. And the second, should not be much richer than *three to one.* On a north wall of my house, rough casting, thus composed, is now perfect, after a lapse of fifty years.*

* *Bullock's blood* and *smith's*, or *furnace*, *cinders pulverized*, mixed with the mortar for *rough casting* or *pointing*, in a small proportion, are known to be highly beneficial. The reason may, probably, be; that they contain *oxygen*, and *carbon*; these are also found, plenteously, in our common air; which, though it consists chiefly of the former and *nitrogen*, in a gaseous state; yet in it are found all the substances capable of existing in an aeriform state, at the common temperature of our globe. *Oxygen* and *carbon*, form the *carbonic acid*, or *fixable air;* which immediately operates, to crystallize, or harden the cement, by its affinity for *lime.* This acid probably exists, ready combined by combustion, in the *cinders;* and produces, at once, its effects on the *lime;* which must otherwise harden, or crystallize, by the more tedious process of collecting the *acid*, or its component parts, from the atmosphere. Whether this theory be or not chymically correct, the effects of these additions to the cement, are practically known; and it requires practice, to ascertain the proportions. Pointing, or rough cast, *forced*, to harden too quick, cracks, and will not adhere. They should never be laid on in very hot weather; which dries away the moisture necessary to crystallization. Frost injures mortar of any composition; if it occurs before induration. Ignorant or conceited workmen, think liming high is a safeguard. Those who (too commonly) have more work than they can faithfully perform in the season, put off the pointing till it is too far advanced; and vainly endeavour to repair the inconveniencies of delay, by over liming, or forcing.

The *Romans* were attached to the system of thick walls, formed in various modes. Some of them were faced with large stone, tied by headers, or binders, in proper places; filled, in the middle, with pebbles or small stones; and embodied by pouring in grout, or thin mortar.—Much discussion has been had on the subject of their masonry; as well as on the nature and qualities of the *Roman cement*. *Loriot* thought he had discovered the mode of building; and the cement of the ancients. But none succeed by pursuing his plans, or recipe, in large works. He proposed erecting walls, between two frames placed at the distances required, boarded up; tight, and capable of holding grout or cement of a certain composition. Pebbles and stones, of any shape, or size, were to be thrown in these cases, at random. The grout was to be poured in, from time to time to fill the interstices: and the frames were to stand, till the wall was dry and consolidated. In small *baths*, *cisterns*, and *vats*, something like his mode has succeeded here. Not having seen his book for many years, I have not a perfect recollection of his plan, or composition.

It appears to be most probable, and it is now generally conceded, that the cement of the ancients, has acquired its celebrity by the help of *time;* which has afforded the opportunity, through ages, to the *lime*, to attract and recover the *fixable air;* and thereby the mortar has been again turned into stone. *Time*, in this case, out of its usual course, strengthens; and supplies the deficiencies of human art.

The mortar of the old *Irish castles*, built before the *æra* of *Irish* history, and dispersed through that kingdom; is as perfectly consolidated, as can be any *Roman*,

or other ancient cement. I have seen, at the old city of *Cashel*, in *Ireland* the fragments of a stupendous ruin, covering several acres. I saw many large and small pieces of masonry, broken up for transportation, with sledges, and other tools. It was more easy to split and break the stones than the mortar, which appeared to me to be composed of common lime and sand. I have seen such ruins, more or less preserved, in several other parts of *Ireland*; and they are all of similar composition. The walls are very thick; but the stones are most commonly large, and so far as I could judge by the appearance of the mortar, it had not been originally composed of a great proportion of lime. Its appearance was often dusky; but *Irish* lime is not so clear and, I believe, has not near the strength our lime possesses. Our land, of equal quality, and measure, would be ruined, with half the lime they allow to an acre.

The astonishing frequency of these castles, in most quarters of their island, furnishes numerous records, preserved from the remotest ages, of the early capacity of the *Irish*, in the mechanic arts. But they remain monuments, and should be warnings, to evince, that the arts of peace have never been durably established there. No country is more capable, by nature, of the highest improvement in *agriculture*, and all the prosperity of which it is the source. The uncultivated state of a great portion of it, is therefore the more deplorable. It is devoutly to be wished, that we may "learn to be wise by others harms."—*Ireland*, for aught we know, once possessed as much freedom as we enjoy. The foundations of these strong holds may have been laid on the ruins of liberty.—*Their* wild theorists, who build airy

castles, may have engendered, and produced by disunion, the distractions and contests, which immoveably fixed these real fortresses, for usurpation and power. The desolation of the country, and the vassalage of the people, followed of course.—The lordly chieftains, who held these once formidable citadels, have long before them, mouldered into dust; and left these evidences of their greatness, more durable than themselves, or their dominion. But it is questionable whether the condition of the great mass of the descendants of their vassals, when compared with that of their ancestors, is yet ameliorated, in any important degree.

At *Cashel* (22 years ago) I ascended a perfectly well preserved circular stair way, of cut stone; in a round tower wonderfully strong and lofty, and of neat masonry. It was, I think, 100 feet high; and in good preservation; though neither tradition, or history, relates the time of its erection, with any certainty. It was covered with a *dome roof*, of immense cut stone; and there were at various heights, apertures for light, probably also for annoyance of assailants, and loop holes for archery. There were platforms at such openings, connected with the stair way. The prospects, from these *look outs*, were singularly extensive, diversified, and interesting. But the bald and bleak mountains, small streams, desert wastes, and sombre bogs, of *Ireland;* though parts of that country afford scenes of novelty, curious, and often grand and picturesque; cannot be otherwise than dreary and unpleasant to an *American;* accustomed to boundless and stately forests, large rivers, woody vales, wavy heights richly clad, and the variegated products, of nature in her prime.

This ancient and respectable kingdom, in the route of my hasty passage through several parts of it, was not then so much desolated and distracted, as it has since been. Fine improvements in the country, and magnificent structures, now much encreased, in their cities, were not then rare. Hospitality to strangers, it behoves me to say, was not confined to particular grades in society. The lowliest cottager or peasant, shared, if it were accepted, his *very humble fare.* In the kindness of the host, was forgot, the *mud and straw built cabbin;* which admitted of no dissertation upon *masonry and materials.* It would be well for those of our countrymen, who are even the worst lodged, and the most discontented, to compare their lot, with that of an *Irish peasant:* who would, nevertheless, be contented, cheerful, and happy, under all his burthens, and regardless of all his privations; if he were not too willingly rouzed and stimulated by others, to ruinous measures of ferocity and rage. Happiness, quietude and plenty, are, *here*, within the reach of every industrious member of society. And all might enjoy these blessings—"*sua si bona norint.*"

RICHARD PETERS.

Belmont, January 20*th*, 1808.

On Orchards.

Read March, 8th, 1808.

Belmont, February 17th, 1808.

Sir,

I send to you, that it may be communicated to the society, an excellent letter from *W. Coxe Esq. of Burlington*, of whom I requested the favour of his information on the subject of it. He is judiciously, and with spirit, prosecuting an extensive plan of nurseries and orchards, unrivalled in this country. One sheet of such communication of actual practice, is more instructive than a quire of theory. His orchards have not yet arrived at sufficient maturity, to determine, whether the practice he is pursuing will be beneficial, when they are in full bearing. For young trees, there is no doubt of its great advantages. But I still have my doubts, whether enriching and constantly cultivating old orchards, will be found advantageous. *Occasionally* ploughing an old orchard is serviceable, to promote the health of the trees. But manuring and loosening the soil too much, I fear cause them to overbear, and by forwarding the fruit too soon, to drop before the season for gathering to keep, or for cyder. In the southern part of our state (*New Garden, New London, &c.*) they have large orchards, on lands absolutely worn out; and fit for little else. Their fruit remains till the proper season; and they gather abundant crops. There is something, no doubt, in the change of the product; for I know that trees will grow wonderfully, on fields where grain has ceased to thrive. But their soil is naturally poor.

I have tried several of Mr. Coxe's modes. I was persuaded to adopt the mode No. 5, of deep holes, to supercede the necessity of stakes; and under the idea which I am told is adopted in east Jersey, viz. that the growth would be accelerated. But I did not mix lime with the dung; for I know this to be a sure way of rendering parts of the dung inoperative. Many of my trees died, eaten by vermin; or perished by other misfortunes. The shallow planting (and if any thing is put in the holes, it should be the surface mould, well rotted compost, or rich native earth) always succeeds the best. Top dressing far exceeds any other application of manure: in this I include *plaster*. My old *Wirtemberg* gardener, who lived many years in the Duke's service at *Stutgard*, is the most lucky in planting trees, of any one I have known. This branch of his trade seems to be his *fort*. He always plants shallow, and gives a top dressing. Some of my deep planted trees are, however, very flourishing; after dwindling at first.

Whether or not they shoot out roots near the surface, I do not know. *Wheat* will do this, if planted too deep; and what is below the roots thus sent forth, will perish. But trees are differently organized.

Mr. *Coxe's* No. 9 reminds me of a fact forty years old. I had a fine nursery then of my own; as the business of nursery men, was not then followed as it is now. I determined to plant a tolerably large orchard, which is now in good condition. I *selected* the most thriving, clean barked, and healthy apple trees, from my own nursery; and they were really handsome and healthy trees. I procured some equally good, from a *German* neighbour; who thought that every thing should

be invariably planted in the same kind of soil, in which the plant, or seed, originally grew. I very early in life disbelieved this, as I do now. That a fair trial might be made, I sent to a *Henry Maag*, in the neck below the city, who had a nursery on a *stiff clay* soil; mine being light and loamy. He sent me, I think, fifty trees, and at least half of them apparently worthless. The roots were hacked and lacerated, and the stocks rigid and mossy. Only the necessity of filling up my orchard, and the desire to try the experiment, induced me to plant them. For the first year they retained their appearance; and mine out grew them. But the second season of growth surprised me. They took the start of all the other trees, held their advantage, and I think they are now the best trees in my orchard. Their kinds are similar to those of the other trees. So that I conceive Mr. *Coxe* need not fear bringing trees from a clayey, stiff soil, to his well attended light ground. The clay farmer, will be benefitted by getting his trees from Mr. *Coxe*, as will also farmers and horticulturists on every kind of soil; if he continues to prosecute his bold and highly meritorious undertaking. The change of locality will be as serviceable on similar soils, as the changes from one to another, on soils differently composed. I do not mean to say that changes are *always* necessary. Or that certain species of trees and plants do not generally thrive best, in soils wherein they are indigenous. That position would be against experience; and as much too broad, as its direct reverse would be too narrow. But trees or plants brought from a worse to a better soil, always improve; as they do taken from a cold or inhospitable climate, and plant-

ed in one more genial and temperate. General *Lincoln* gave me a very mean ear of indian corn, brought from some place far north; I think, beyond *Michilimachinac.* I had, from this seed, ameliorated young corn on my table, before it appeared in the market of Philadelphia; where it is brought very early. Plants or trees raised in a *good soil*, will thrive better on one *worse* or *bad*, if transplanted, than those of its own produce; if the soils are not too widely different in quality. But the reverse of this practice is the most certain. The corn I mention (and in other similar instances) continued to come early, for two or three years. It mended progressively in size, and finally became naturalized; and mixed with my field crops. I have experienced this, with several other grains and seeds. My friend Colonel *Johnston*, who was a commissioner of this state to negotiate with the northern Indians in 1784, reminds me of his having furnished to me, in that year, a curious ear of indian corn, brought from the north west of *Detroit.* It was *conical*, and the rows all *spiral*, running thus from the bottom to the tip of the cob. It was an early corn for several years; encreased from a small to a full and large grain; but gradually ceased to come early, though always planted distant from other corn. It became a field corn, and continued spiral, in some degree, for several years; till it gradually mixed with the common corn; and the distinct species was lost.

Last season I obtained five grains of corn; brought by Captain *Lewis*, from the borders of the *Pacific ocean.* I forgot to plant it in time; so that it was not put in the ground till the last of June. I had seven complete ears, the grain was much more plump and larger than that

planted, and it was fit for boiling or roasting in six weeks. I am satisfied we can have two crops of this *dwarf corn*, in one season. I have sent one of the ears to *Maryland.* This corn will, in a course of time, change its nature, and assimilate with our own. I never had any seed that did not change, with all the care I could take. The fact is so with me, whatever be the cause: be it soil, climate, or mixture of the *farina fecundans* of other corn. One must be isolated, to try this experiment, far from any grain of the same species. The *farina* is wafted by winds, to great distances.

22d February, 1808.

I have examined my deep planted apple trees, in different parts of the young orchard, by digging down as low as the original roots; 2 feet and 2 1-2 feet deep.—I find they have sent forth numerous roots, in all directions; from those planted with the trees, about 6 or 7 years ago, to those in the surface mould; which are the most vigorous. *Nature* takes her own course; and thus directs where *we* should place the roots of trees transplanted. Fibrous roots are frequent on the stocks; and are larger or smaller, according to the kinds of *substrata*, they have to penetrate. On part of this orchard, I raised my heavy crop of wheat, the last season. In it there are 200 trees of various kinds, all grafted; a few excepted, but not all planted deep. The surface is very well dressed and tilled, and in high order. I found the old surface in a brown or black stratum (turned down by the trench plough many years ago) affording a fine nourishment to the roots. But the lower roots are generally mean, in comparison with those shot out in

the surface mould. This accounts for many of my trees, especially the largest, dwindling at first, and being now in remarkable vigour. They wanted healthy and genial supplies, till the upper roots shot forth in the surface mould, and near the sun and air. My old gardener, who never liked my scheme, thinks these lower roots "*gifft ziehers;*" that is, "*poison suckers.*" On perusing "*Bucknal's orchardist*" I find he is an enemy to deep planting; and recommends top dressing, and loosening the soil for young trees; and says that planting potatoes, in young orchards, for *hogs* to root out, is highly beneficial. He asserts, that "whenever the "roots penetrate into the under *strata*, and are still tend-"ing downwards, they are apt to draw a crude indi-"gestible fluid, which the organs of the more delicate "fruit bearing trees are incapable of converting into "such balsamic juices as to produce fine fruit." It seems therefore, that placing the roots purposely, where he points out the injury of their arriving accidentally, is palpably improper. He goes so far as to advise those, who *will plant* trees in unkindly soils, to raise mounds of good earth above the surface, for them to grow in. His mode of *root pruning*, and his practice of pruning orchards, ought to be generally known. We always cut off the *tap root;* but I believe few, if any, of us prune the roots afterwards. He directs the superfluous branches to be *cut close*, and the part brushed over with tar, and a small mixture of sublimate, or even verdigrease, to destroy or keep off insects, with a little whiting or chalk, to give it consistency. The bark soon grows over the wound; but where projections, or snags, are left, it never does. His directions are so much es-

teemed in *England*, that he received several premiums. It is to be wished that this work were reprinted here; that every one having even the smallest orchard might possess it. It might probably be reprinted, and sold at a price one third, or perhaps one half less than that obtained by importers of the copy from England.

I am, Sir,

Your obedient Servant,

RICHARD PETERS.

DR. JAMES MEASE,
Secretary Agric. Soc. Philad.

Burlington, February 5th, 1808.

Dear Sir,

The opinion that clover possesses some property injurious to the growth of apple trees, had been suggested to me by several men of observation and practical information previous to the receipt of your letter of last spring. Some of my own experiments in the planting of orchards had not succeeded to the extent of my expectations, and their failure was ascribed to the cultivation of clover. I was well convinced of the beneficial effects which had been derived to the agriculture of our country from the introduction of clover, and being desirous of availing myself of its ameliorating properties in the improvement of my farm, I was alarmed by an apprehension of its interference with a favourite scheme I had in contemplation; that of enriching my neighbourhood and improving my own property, by

the introduction of the finest table and liquor fruits of Europe and America, into an extensive orchard establishment on my lands in the vicinity of this town. I therefore determined to ascertain the truth of the opinion by a series of experiments. These I have executed with care; and the result has perfectly convinced me, that young orchards thrive in proportion to the goodness of the soil, and the degree of cultivation bestowed on them; that the injury they sustain from grass or grain, depends on the extent to which the particular growth or nature of that grass or grain, may prevent the communication of moisture and nourishment to the roots of the trees from the earth or atmosphere: that so far as clover produces this effect, it is injurious; but that it has nothing in its nature peculiarly deleterious. On the contrary, its long tap roots penetrating and dividing the soil encreases very much its capacity to nourish the roots of the trees; and did it not afford an inviting food to field mice and moles, it would be found less pernicious to orchards than any permanent grass, or any species of grain which shall be permitted to arrive at full maturity on the ground, buckwheat alone excepted. The point of most importance in the planting of young trees, is to preserve the roots so near the surface of the earth, that by keeping the soil around them in a loose and mellow state, free from weeds, grain or grass, they may feel the salutary influence of the sun, air and rain; the last of which in our dry climate is particularly essential to their success, for several years after planting; for this reason all kinds of fallow crops, such as potatoes, vines and Indian corn, particularly the last, are peculiarly adapted to the first and

second year's cultivation of orchards. An opinion prevails among our farmers that rye is a more pernicious crop for orchards than any other grain; for this I can see no sound reason. I am induced from my own observation to believe, that all grains are injurious, in proportion to their proximity to the tree, their power of exhausting the moisture, and from their colour or even surface producing a great proportion of intense reflected heat. I am so fully convinced of this truth that I have the last summer caused a circle of three to six feet diameter, to be dug at two several times round every tree in my orchards, not under the plough, whether among wheat, rye, oats or grass; and although this operation when extended to several thousand trees, which at present compose my orchards, necessarily is productive of much expense and trouble, I am repaid fourfold in the increased vigor of my trees, and still more in their preservation from our summer droughts. Although I pretend to the merit of no new discovery in the cultivation of orchards, I may claim that of sparing no pains or expense in planting, pruning and cultivating them. That you may be enabled to judge of my mode of treating them, and the foundation for the opinions I have ventured to offer, I have taken the liberty of extracting from my books the notes of several of my experiments, which I can venture to assert were made with care and recorded with accuracy. I have for many years derived a great degree of pleasure from the pursuit of this subject; it is in its nature calculated to afford much rational enjoyment to an active mind, and if I am not much deceived, will prove a source of substantial comfort and profit to the prudent practical far-

mers of our country. If my exertions can in any degree add to the numerous inducements which already exist, to urge our landed gentlemen to improve their estates by plantations of the finer kinds of table and liquor fruits, I shall be amply rewarded for the time and money I have expended in the pursuit.

Experiment No. I.

In the fall of 1794—5, I commenced the plantation of an orchard on a good loamy soil and in a favourable situation. Being a novice in the business, and having no correct information, for at that time a young orchard was a perfect novelty in my neighbourhood; the holes were dug very deep and narrow, with the mistaken expectation of its being necessary to support the trees. The ground was for several years kept in clover, and part of it being rather stiff, the natural green grass prevailed over the clover, so as to injure the trees extremely. The trees grew slowly; many of them have since been taken up and replaced by others planted in shallower and wider holes; the latter plantations have gained fast upon the first; and since I have had the ground around the trees dug or ploughed, the whole orchard containing about three hundred and forty trees, grows vigorously, and has an uniform appearance.

No. II.

In the fall of 1802, I began another orchard, which in the two following seasons was enlarged to about three hundred and forty trees. These trees were large and vigorous. The holes were dug wide, and the ground around them manured highly with stable dung the fol-

lowing winter. The ground being in clover remained uncultivated for two years. The drought of the two following summers killed many of the trees, and the field mice which found a comfortable winter shelter destroyed many more. The orchard did not flourish in a manner which the goodness of the soil and my great care led me to expect. I determined therefore to plough it thoroughly, and to break in upon my established course of crops for the purpose of recovering the trees by cultivation. The event has fully answered my wishes; the trees now flourish with uncommon vigour and at present exhibit a promising appearance, being now so large as to be completely established and out of danger.

No. III.

In the fall of 1803, I planted forty-five trees in a lot adjoining to No. 2. The trees were not large, but the ground being under constant cultivation they grew rapidly. None of them (one excepted) died by the drought of the following summer, which proved so destructive to their neighbours in the clover ground. It was my observation of these trees which first led me to change my mode of treating my young orchards.

No. V.

In the fall of 1804, I planted four hundred and eighty-four trees in a clover field. The holes were dug four feet wide, two spits deep; the lower one thrown away, and its place supplied by a compost manure, composed of stable dung, a small portion of river mud and a large proportion of lime, about a waggon load of the mixture was applied to six trees; in some instances it was mix-

ed in the holes with the earth in planting, in others it was thrown around the tree on the surface after planting. The ground remained in clover unploughed and undug the whole of the following summer. The trees put out well the first spring, but the drought of the succeeding summer prevented their growth, those which did not perish were nearly stationary. I replaced one hundred and thirty of them the following fall, since which I have replanted nearly one third more, and have kept the ground in corn for two successive years, by which means the surviving trees have perfectly recovered, and together with the replanted trees at present exhibit an uniform and vigorous appearance, promising in every respect to be a fine orchard.

No. VI.

In November 1805, I planted three hundred and eleven trees adjoining to No. 5. The holes prepared in the same manner, many of the trees large, transplanted a second time; I mixed no stable dung with the compost, which was composed of river mud and ashes with a small portion of lime. This I put round the trees on the surface, a waggon load to ten of them.—The ground had been previously planted with corn.—Although generally deemed an exhausting crop, I have continued it in corn for three successive years; except part which has been constantly occupied (to adopt the language of this part of New-Jersey) in a truck patch. These trees have grown with a vigor I never saw equalled. In two years but one has died, and that was lately destroyed by the field mice: and the or-

chard is allowed to be the handsomest in this part of the country.

No. VII.

In November 1805, at the same time with the preceding experiment, I planted two hundred and fifty-two trees on a corn fallow; the holes prepared as in No. 6. I applied stable manure, hauled out the preceding spring, in about the same proportion around the trees. In the following spring the ground which was in high order, having been manured with about three hundred bushels of leached ashes per acre, was sown with oats: the oats grew finely, and the trees put out very beautifully. They grew well for some time, but as the oats by their growth exhausted the moisture from the earth (which had not been dug) the trees withered, and by the time the oats ripened about forty of the trees had perished. As soon as the oats were cut I had the ground ploughed. This checked the destruction of the trees: those which had not previously perished soon recovered in some degree a healthful appearance, and took a second growth in the autumn. The trees replanted and the survivors of the original plantation have been dug round twice in the last season, and although the ground has been sown with wheat and is now in clover, they generally look well and promising, but in no degree to be compared with those manured with the compost of mud, ashes and lime, and kept under cultivation.

No. VIII.

In October 1806, I planted part of an orchard of two hundred and ten trees, which I completed in the follow-

ing December; the ground prepared and manured with ashes for a corn crop; the trees planted and manured with stable dung hauled out the preceding spring. In the spring of 1807, the ground was sown with oats. All the trees planted in December, and dug after the oats had attained to some size have grown well. Of those planted on the 24th of October, one third part perished in the following summer, which I attribute to their being transplanted before the sap had ceased to flow.—This remark applies particularly to the Hewe's Crab, which continues to grow later in the fall than any other apple tree. Some kinds did not suffer at all, while the greater part of others perished. The comparative effects of the dung and mud are observable in this plantation.

No. IX.

In the month of October 1806, at the same time with the preceding experiment, I planted about one hundred and eighty apple trees on a piece of ground ploughed for, but not sowed with, oats the preceding spring. The holes were dug, and the trees manured with stable dung, precisely in the same manner with No. 8. The soil was much sandier than either of the fields mentioned in numbers 7 and 8. The ground was full of weeds and very rough. In the following spring it was manured with ashes, and planted in corn. Forty of the trees had been procured from a distant nursery, the soil of which was so stiff as to cause much injury to the roots in digging or rather grubbing them; they were extremely short so as to leave me little expectation of their growing in my light soil. Notwithstanding all these obstacles the trees though planted on

the 24th of October, from being under cultivation have generally grown finely, and at present exhibit a favourable appearance, few of them having perished, and those few principally from the field mice; but the difference between the mud and dung is here also very perceptible.

From the result of the foregoing experiments I infer, that trees planted without manure in the holes, and the roots covered with the surface earth with an external covering of mellow mud or rich mould, is the best mode for the first year. That if the ground is poor, stable manure is the least proper kind to be used, being from its nature least able to resist the destructive effects of our summer droughts, and affording a shelter to vermin equally pernicious in the winter, particularly in light soils; that rich earth or river and meadow mud ameliorated by frost or putrefaction, either in its simple state, or mixed with ashes, lime or perfectly rotten dung, is of all others, after the first year, the best dressing, to be spread on the surface and ploughed in.—That cultivation is essential to the growth of orchards, which thrive in proportion to the degree of it which they receive.

I have, under a full conviction of the correctness of these opinions, this fall planted another orchard of four hundred and eighty trees, one half of European and the other half of American kinds, in a light, sandy soil, with two cart loads of meadow mud, spread in a circle of about 10 feet diameter round each tree on the surface of the earth. This ground I mean to cultivate in corn and other fallow crops for two years, when I hope the trees will be sufficiently established to admit of winter grain and clo-

ver. This is the mode I prefer from my past experience, and I have little doubt of its complete success, especially if the further precaution of digging once or twice round each tree in each season is attended to (whether the ground be sown with grain or clover) for two or three years. It may not be amiss here to mention, that I do not include buckwheat in the pernicious list of grains, because it keeps the ground in a loose state, and ripens at a season of the year when no injury is produced by it to the trees; and from its peculiar growth and color, I doubt whether buckwheat ripening even in July, would produce a sufficient degree of reflected heat to be injurious to an orchard.

I am, dear sir,

With sentiments of esteem and respect,

Your obedient servant,

WM. COXE.

RICHARD PETERS, ESQ.

On coarse Flour, brown Bread, and the Force of Habit, as it relates to Esculents. By Richard Peters.

Read March 8th, 1808.

In execution of our plan to throw out thoughts and facts on a variety of subjects, as *themes* to elicit from others more valuable information, I send the following; as the subject does not appear to have been mentioned in any communication. I have seen it scientifically and ably treated, in some foreign books, to which I have not now access. I have long practised on the opinion I state; but if the opinions of others are different, I shall not eat my *house-hold bread*, or *brown biscuit*, with the less zest, or contentment. I am so little refined in my palate, that I prefer good and well raised *rye bread*, to any other. So that I have no great chance of success, in either my precepts or example. If those who can get no other bread are to be found in this country, I should be happy to comfort them, in a situation which is to me a matter of choice. I have always accounted a good common ship biscuit a treat; and prefer it to those supplied for the cabbin. However home spun this propensity may be deemed, it has been one to me gratifying, and promotive of health.

It has always appeared to me that the preference given to bread made of *superfine flour*, was a mistake in our dietetic system.

Grain consists of *mucilage* or *starch*, and *animalized matter;* called by the French chymists *vegeto-animal.* Of the former there are three, and of the latter two

fifths, in good wheat; and this latter (with resin and sometimes oil) is contained in the outer coat, or skin; which is called *offal*, by those who, by every means in their power, detach it in the manufacture of fine flour. Yet good and well made bread depends on the admixture of both these substances, in due proportions. In such proportions they must exist, to constitute wholesome and good meal or flour. They exist in the grain, in a state of mechanical mixture; and not of chymical union. This union is accomplished in grain, by the process of germination, or malting. The result is saccharine matter, or sugar; which, until this union, was not possessed perfectly by either of the parts. The operations of fermenting, and baking the flour so as to form it into good and wholesome bread, produce the like union, and effect. This account and analysis are taken from celebrated writers.

By this statement it seems to me, that the more the vegeto-animal part is detached, in refining the flour, the more the necessary proportions are destroyed, and the less nutritive and healthful, this esculent becomes. There is the less of the materials necessary to form sugar, which of itself is highly nutritious. Crews of ships in distress, have been sustained on sugar alone, for a great length of time. Nature has provided all the parts of the grain to correct the qualities of each other; and all to assist in the uses designed. The finer the flour, the more of the aliment is deficient; and the more must be required of the residuum for sustenance.* After the

* An Infusion of bran or offal of grain, is highly nutritive; and the longer it is macerated, so as to avoid acidulating, the

grade of perhaps the best middlings, all the other and extra manufacture is to gratify prejudice of education, and habit. It is questionable whether those who value themselves on being "*sworn at High gate*" gain, in this over refined gratification, any solid advantages. I am well aware that nothing I can say, will induce them to violate their oath.

The old king of *Prussia's* soldiers ate, on a campaign, little of any thing farinaceous, except *ammunition bread.* This was made of the grain triturated or ground, but not bolted; being passed through hand sieves, which detached no great proportion of the coat of the grain. The *Dutch* sailors were supplied with such bread; and chiefly made of rye*. Since our flour mills have gain-

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better. But sour food is the most grateful and alimentary to swine. One gallon of *sour wash* goes farther than two of sweet. *Dry rotten wood* should be constantly in the pen; that the hogs, when confined for fatting, may eat it at pleasure. Nature points out this absorbent (or whatever it may be) as a remedy or preventive. They will leave their food to *devour* the rotten wood, when they require it. I have not lost a fatting hog for more than 30 years, when I used it; but have suffered by neglecting it. Some of my neighbours met with frequent losses of fatting hogs, till I informed them of my practice; of which I was told by a woman from *East Jersey*, before our revolutionary war. She said it was then known and practised there.

* Although the *Dutch* ship bread is, in appearance disgusting, yet I risque the disapprobation of those of better taste, by saying that it is by no means so to the palate, if ate without prejudice; as it is by those for whose use it is made. A ludicrous accident (which I relate *meo periculo*) made

ed such high perfection in their capacity to manufacture superfine flour, the ship bread (in my estimation) is, by no means so sweet and nutritive, as that made of the ship stuff of former times. The oil and animalized matter of the coat or skin, correct the costive qualities of the starch, or mucilage, and add to the alimentary

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this discovery to me, some years ago. I was investigating into a controversy brought before me, on the admiralty side of the district court, by some *American* seamen, who complained against their captain, under the act of Congress giving one day's pay to every mariner unnecessarily put on short allowance during a voyage; which in this case was from *Amsterdam*. The principal allegation was that of having no bread, wholesome, or fit for the sustenance of the crew. Specimens were produced, by the seamen, of *Dutch ship bread;* which, being such as we are not accustomed to see, looked very forbidding. Curiosity induced me to taste one of those which seemed the best. My attention was engaged in, and my mind occupied by, an argument on the construction of a clause in the law. Unconscious to my self of the circumstance, I continued eating the bread, till the small pieces exhibited were consumed. The counsel intermitted his argument, on perceiving that the testimony had, unluckily for his client's allegation, disappeared. A sailor stepped forward, under the apprehension of a discomfiture, with what he called another witness;—another piece of bread, probably selected for the purpose. The mouldy and carbonaceous appearance of this specimen, would have gone far to prove the allegation. But having been before satisfied by other circumstances, that the whole complaint was vexatious; and that the bread was generally such as was usually supplied to the *Dutch* seamen; I put an end to the ridicule of the transaction, as well as the controversy, by dismissing the suit.

properties. Whether more of these are now in the fine flour, and, of course, less in the ship stuff; or whether they are banished from both, I cannot, from any knowledge of the fact, assert.

My much lamented, most intelligent, and worthy friend, the late *Baron Steuben*, was educated, in his military profession, under the eye of the great *Frederick;* having been one of his aids, and spent, in the *Prussian* service, much of his valuable life. He was (as we all know, who knew him) singularly well informed on such subjects. He has often told me, that the peculiar healthfulness of the *Prussian* soldiers was, in a great measure, to be attributed to their *ammunition bread;* which was accounted the most wholesome and nutritious part of their ration. The *Baron* added with his usual *naivetè*, that this bread was only good for the health of *soldiers;* but *gentlemen* would prefer being sick on better bread.

When, during the revolutionary war, I had an anxious, laborious, and often perplexing share, in conducting the War Department, I was advised to direct the mixing more of what is called the *offal*, with the flour for the troops, in a time of great scarcity. But I knew the danger and difficulties in precarious times (and indeed any other) of encountering common prejudices. A wholesome and very considerable supply of *smoked herrings*, and *dried clams* for soup, had been provided as substitutes, in part, for flesh. Many drums and fifes of the *Pennsylvania* line (on the first or second issue of these articles) were employed by the soldiers, in escorting out of camp under the rogues march, these parts of the ration suspended on poles; in grotesque proces-

sion.—If the *speckled flour* had been furnished, it would have accompanied them; and possibly the discontents would have reached other lines. Yet many of the *Pennsylvania* soldiers were Irishmen, to whom, in their own country, a *herring* would have been a treat, and a *clam* a curiosity. Though convinced that the measure suggested as to the flour, would have been a beneficial and healthy supply, this *janizary hint* was sufficient to forbid the step. Any other kind of grain, prepared in the customary way, would have less violated the habits of our people.—From the commander in chief (who never feasted while others suffered; though indian bread was always provided for him at his table, as he preferred it to any other, through his life,) to the lowest follower of the army, *indian corn*, at one distressing period, was the sole esculent they possessed. The bad roads had interposed difficulties to the transportation, and prevented other supplies arriving at camp; yet no serious evils ensued. A committee of field officers of one of the state lines, waited on the general, to represent the distress and discontents of their troops. Dinner at head quarters was nearly ready to serve up; and he, with his usual complacency and politeness, asked them to dine, before they received a final opinion as to their mission; whereof he had been apprized. *Indian corn* in various preparations, much of it *parched*, and nothing else, composed the banquet for a large company; and the liquor was as humble as the esculent. The committee partook, with cheerfulness and admiration; and never renewed the subject of their mission. The dinner was a sufficient answer; and their report of the occurrence, on their return, silenced every murmur.

The *Prussian* discipline and tactics would have created less discontent, than issuing coarse wheat meal or flour, even under privations of other supplies;—to say nothing about serving out *ammunition bread.*

Habit is, according to the trite adage, a second nature. A singular instance of this, occurred in 1776. When our military systems were unfortunately calculated for temporary expedients; the objections to a permanent army of our own, had nearly brought us and our affairs, within the power of that of our enemy. A body of troops, intended to consist of 10000 men, was formed of a kind of militia, engaged for a few months, composed chiefly of country people, unaccustomed to a military life; and collected in what was called "*the flying camp*" in which they assembled in *New Jersey.* The police of a camp, including regulations of diet, cooking, and cleanliness, were unknown, or little attended to. Indeed before the department of inspector general was created, and placed under the direction of the *Baron Steuben*, more of our troops fell by the filth, originating the diseases of the camp, than by the swords of the enemy. On this part of our army, the mortality was truly destructive. On the return of the remnants of this corps, on their way to their homes (where one half of them never arrived) the roads exhibited frequent, and melancholy spectacles of the dying and dead. They had indulged themselves on green corn; and had been fed on fresh meat, with little or no salt, and wheat flour. Many of them were from the southern states, and not accustomed to this diet: these took the route through *Philadelphia;* where the hospitals were crowded with the sick. *Diarrhæas, dyssen-*

teries, and *fevers*, carried them off in great numbers. Many died in the streets, and in the markets; yet every medical aid, and every possible comfort were afforded to them. They loathed, and many refused, the soups and provisions offered by the kindness of the citizens, or provided in the hospitals. General *Stevens*, who had been bred a physician, and resided in *Virginia*, called at the war office, on his way to join the army; and the distressing calamity was detailed to him. He said we did not know how to treat the maladies of Virginians and Marylanders. The director of the military hospital, and the commissary of provisions, were sent for, and came. The general desired, and orders were accordingly given, that all the *bacon* and *indian corn*, that could be immediately procured, should be purchased; and the corn ground into meal *rather coarse*. The troops were at once put on this diet; it operated like magick; and accomplished what the medical art could not effect. Those who loathed every thing else, would if caution had not been used, have greedily, and dangerously, devoured these articles; which had been, at home, their habitual fare. In a very short time, there was scarcely a dangerous case to be found; those thus fed, having generally recovered. Many of them told me, that as soon as they smelt the *rashers* and *hoe cake*, they felt, as they expressed themselves, "*quite lively*," and were confident of getting home well; to which, no doubt, this fortunate persuasion, in no small degree, contributed.*

* Dr. *Rush* informs me, that (in 1777) while he had the direction of a military hospital at Morris Town, he cured

Kiln dried grain is the least nutritious, probably because the oil and animalized matter are detached, by a degree of combustion, in the operation. This process is said to be indispensable, to fit *indian corn meal* for exportation; but this does not prove its salubrity. Let swine be fed with indian corn meal thus prepared, and those who make the experiment will not attempt it again. Any kiln drying dissipates the oil and vegeto-animal matter, in a greater or less degree; but if carried no farther than merely to destroy its vegetating principles, it is said not to injure its alimentary qualities.

Lord *Dundonald* recommends *malting* the grain on which *horses* are fed; to form and fix the saccharine quality.

Colonel *Kowatch*, who, in our service, commanded the infantry of *Pulaski's* legion, had been an old partizan officer, in the north of *Europe;* and had commanded a large corps of irregular horse,—either *Cossacks*, *Croats*, or *Pandours*. He fled hither, after the troubles of *Poland*. He told me, that they often *baked* the chopped or ground grain, for their horses; having previously formed it into portable cakes. It was fermented, or raised, in an expeditious and simple way, by a kind of *leven*. With this, they sometimes used *oil cakes*. He said *baked* provender went twice as far as raw meal, or grain. The saccharine quality was, no doubt, produced by this process; and its alimentary properties en-

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the same diseases by a like change of diet. The rations of fresh meat, were exchanged with the farmers, for salt pork and bacon.

creased.* General *Pulaski* had a favorite *charger*, to whom he often gave *bread:* which the animal seemed to enjoy far beyond any other food. In *Holland* it is a common practice to give horses rye *bread*, or baked provender.—The late sheriff *Penrose*, who had a fine team of working horses, was in the habit of buying condemned *ship bread*, as the most nutritious, and cheapest horse feed. He said that others knew, and profited by its advantages.

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* *Kowatch* spoke a barbarous *Latin*, which he said was the common language of parts of the north of *Europe;* and particularly of *Hungary* or *Bohemia*, in one of which districts of that region, he was born. He wrote the *Latin* tolerably pure; but spoke with an accentuation very different from that to which we are accustomed: so that I with difficulty understood his conversation. He spoke *German* and some *French;* both tinctured with his *Hungarian* accent. He thought our pronunciation vitiated, and asked me whether *we* ought not to yield to *them*, who had, from the time of the *Romans*, spoke Latin as a vernacular tongue? We, he said, derived our pronunciation from those, among whom it was a dead language.

Herbage and Shrubs spontaneously produced, after Forest Timber burnt, by firing the Woods. By Richard Peters.

Read March 8th, 1808.

Belmont, February 10th, 1808.

Sir,

In the paper you communicated, as a supplement to that with which I troubled the society, on the "*changes of timber and plants,*" I perceive that you quote "*Hearne's journey to the northern ocean*" for corroboratory facts; which are similar to some I should have mentioned, had they not then escaped my recollection. On the tract in which I was interested, and noticed, in *Northampton* county, as I was informed by ancient people in its vicinity, *strawberries* were thrown up, in most extraordinary profusion, after the combustion of the *pine timber;* so as to cover a very great proportion of this tract (which contained near 800 acres) where the land was not moist; for parts of this tract consist of meadow ground. The people of the towns, and others, from distances of more than 20 miles, were accustomed to gather and carry off these *strawberries*, in quantities almost incredible. They continued in the greatest abundance, for several years, while the new growth of timber was progressing, and until it finally banished these plants; wherof I saw few, when I attended the survey and division, in 1797. The visitants of this then curious spot, were additionally attracted by some small but deep lakes of spring water, which then afforded, and now contain *trout*, in uncommon plenty. The tract

appeared to me to have been, at some very distant period, the bottom of a lake, rimmed by ridgy and variegated hills, and formed by a large stream which skirts one of its sides; the channel whereof seems evidently to have been changed. White and grey pebbles, and shells of aquatic animals, are found in various parts of its area, distant from the stream. There are now impenetrable thickets of flourishing *white thorn;* through which passages were cut, before the lines could be run. These were not known to have been on the land, when the pines were standing; nor are they common in the neighbourhood. Nothing will grow under pines thickset. In places to which the sun had access, was found a plentiful growth of the herb called here *catnip.*—Whether it be the same also called *catmint (nepeta,)* I am not certain. It grew with singular vigour, where the *strawberries* had been precedently. The *thorn* and *catnip* designate (as this for the most part is) good land: and delight in soils, loose and inclining to sand and loam. But *strawberries*, though they flourish in soils of similar texture, yet, if productive, do not generally indicate fertility. In rich soils, either natural or artificial, they run to vine, and set false fruit; though they blossom profusely, and those bloom the most which produce no fruit. But the barren and prolific blossoms, are easily distinguishable.

The old neighbours dwelt much on the exuberant plenty, and general cover of the *strawberries;* which, they said, could be scented, when perfectly ripe, from a great distance. Some of them described the vast surface and waste of flowers, when the plants blossomed, in a stile, that, if the fact had not been well

attested, would have appeared fiction. This inimitable gala dress of nature, and the immense numbers of bees, with their "*busy hum*," frequenting the blossoms and fruit; with the rugged and diversified mountains on its borders, would have furnished a scene of pastoral imagery, for poetic description.

The county of *Northampton* is remarkable for producing abundance of *honey*. I have counted 120 *straw bee hives* near one farm house; and have been told that others of those rude apiaries, exhibit much greater numbers. The farmers there sow *buckwheat*, as a substitute for better grain, more extensively than in any other district of country. The blossoms afford a pabulum for their bees. They are forced into this culture, by the injuries done, in many parts, to their crops of winter grain by frosts.

There is such a coincidence in some of these, and the facts related by *Hearne*, that I think they not only support each other, but unite in proving the tendency in the system of nature, to changes and successions of the products of the earth.

RICHARD PETERS.

DR. JAMES MEASE,

Secretary Agric. Soc. Philad.

On Trench Ploughing. By Richard Peters.

Read March 8th, 1808.

I did not take sufficient notice of a part of a valuable communication, by Mr. *Kirk*; entitled "*a substitute for trench ploughing*," in which he condemns the subject, for which it is given as a substitute, until I saw it printed off. It is my habit to overlook what does not please me, and enjoy the satisfaction arising from agreeable, and instructive, or practically useful information. But as the society has offered premiums for *trench ploughing*, and culture on grounds thus prepared; I think it a duty, to give my practical knowledge on the subject, as concisely as possible. And this, without the least intention to disapprove of Mr. *Kirk's* apparently *next best* method. That *trench ploughing* has some disadvantages, and will not apply in all soils, is certainly true. But where is the operation in husbandry to be found, of which the same observations may not as truly be made? Let it be recollected that *deep* and *trench* ploughing, are very different operations, both as to mode and effect.

The burying the old soil, exhausted of every fertilizing quality, filled with the seeds of pestiferous weeds, and indestructible stocks and roots; with the bulbs and seeds of garlic, St. John's wort and the daisy; and other such otherwise unconquerable hosts of foes to my culture of profitable crops; was my motive for trenching progressively, at least fifty acres of my farm. Turning down fertile vegetable mould, and bringing up

earth, to receive from the *air* and artificial applications and processes, what the surface precedently possessed, would be a most unnecessary and reprehensible operation. It is therefore only to worn and infested fields, that I ever recommended the application of this practice.

Many years ago I gave an account of my process, and its results. It was not theory, but the actual product of repeated and successful practice. I brought my fields into a fertility, and cleanness of crop, which amply rewarded me; and surprised those who had known those parts of my farm in their apparently hopeless state of exhaustion. My success was attributed to expenditures of money, which could not be afforded by common farmers;—to abundant quantities of manure, which could not be obtained in a common course—to my ground exactly suiting the operation;—in short, to any thing, but the true cause. My example was therefore, not followed by my neighbours; and I have known of but few others, who have adventured on this method; from some of whom I have heard unfavourable accounts. On examination, I perceived they were in too great haste for their profit; and had not given *fair play* to the experiment. I have, for many years, leased my farms on shares; reserving a small part for my own culture, and amusement. On this I always far exceed my tenants, in products; because I do well, what I perform; and confine myself to small fields. I find the *exiguum colito*, far surpasses the *ingentia rura.* I never could prevail on a tenant to *trench plough;* though he enjoyed the advantages of my labour and expence. I am, therefore, neither surprized or mortified, by Mr.

Kirk's disapprobation. There is such a general prejudice against this mode, that I have ceased to combat it. Many of my fields, which had been trenched, have, in the hands of my tenants (comparatively good) regained their cover of weeds and nuisances, from neglect, and the seeds brought from some of my own, and the fields of my neighbours. So that this, like all human arts, has its limit: and weeds infest *all* my rented fields; owing to the culpable neglect of the tenants.

It can easily be perceived, that Mr. *Kirk's* method does not bury the bulbs and roots of weeds; so as to put them beyond the power of vegetation. Let any person attend to the mode detailed in our list of premiums. It will be perceived that the sod of the old surface is entirely covered, by the accession of the *substratum* thrown over it. Whereas the edges of the sods, in ploughing ever so deep, are always exposed to vegetate anew. So that my preference for this practice, is founded in the reason Mr. *Kirk* assigns for condemning it. And it does not appear that he has had any experience in it, to warrant a practical opinion, to which I should certainly pay every reasonable degree of respect. I have not a trenched field, which is not now the better for the operation. I never kept a burthensome stock of working cattle, or horses. A pair of oxen, and four horses, were generally all I had, for a large farm. With these I could *trench* and *fall plough*, as much as I required.* I am positively certain that

*A pair of horses in the paring plough, and a pair of strong, active oxen, in the trench plough, are generally suf-

trenched ground requires, after it has, by lying over a winter in fallow, received its supplies from the air, *less manure*, than that ploughed in any other way. I say not this dogmatically; but from practical conviction. I am as ready, on all occasions, to acknowledge an error, as I am to support a truth.

Plaister does not operate till animal, or vegetable putrefied substances are restored, to trenched soils.

My course was, in four years—

1. In the autumn to trench.

2. A crop of *Indian corn*—sometimes *pease;* or on part *flax*—also *carrots*, *scarcity roots*, *potatoes*, *pumpkins*, and such crops; in which I had great success. I applied *lime*; never exceeding eighty bushels per acre; but commonly fifty. The corn, plaistered, yielded abundantly; but it required *shovelings*, or some dung, in the hills, to give activity to the plaister.

3. Ploughed in the usual way——*dunged*, with about twelve to fifteen cart loads, (two oxen and an horse in the team) to the acre. *Wheat*—whereof I have had from twenty-five, to forty bushels to the acre, perfectly clean--the former not uncommon, on fields which before yielded seven to ten; and that mixed with garlic, most disgustingly.

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ficient. In stiff soils the more strength of draft, the less the animals are fatigued; and the business is the sooner performed. Those who have not horses or oxen competent to the operation, are the least likely to adopt or approve it.—And few of those who could accomplish it if they were so inclined, will permit themselves to believe in its usefulness.

4. Clover, sown on the grain, early in the spring, or in winter.* Parts of some fields, in eight or ten years, were trenched again; and the old sod was perceived to be entirely decayed; and become a manure, with no pests. *Lime*, put on after the first trenching, was found in the greatest depth the plough turned up.

In the fall of 1787, I trenched (among others) a small field of three and one quarter acres. *Cinque-foil*, *garlic*, *daisies*, *twitch*, and such vile vegetation, were its cover. A sandy loam, mixed with *mica*, or isinglass, composed its soil. Its surface, after trenching, looked like the earth of iron, or half-burnt brick clay; though its texture was loose.

In 1789, in the spring, being then in the legislature, I selected from the members, a company of the best farmers of *Lancaster* and *York* counties, to dine; with a view to shew them this forbidding soil, as well as to enjoy their society. They asked me what I intended to sow in it. I told them *hemp*. Some were silent—conceiving I was amusing myself with their credulity. Others supposed me an enthusiastic theorist, and did not spare me, in their observations. I always join in pleasantry; though it be excited at my own expence.

The year preceding, I had laid on about sixty bushels of lime, and sixteen cart loads of dung, to the

*I have seen a publication condemning this practice, which is common among us. I can safely aver, from long experience, that there cannot be a better mode of ensuring a clover crop. I have repeatedly mowed my fields, and had abundant crops. Failures more frequently occur, where clover is sown with spring grain. *Timothy*, *orchard*, *herd*, and such grasses, succeed best, when sown in the autumn.

acre; and planted *potatoes;* of which I had an abundant crop. I sowed *hemp*, and plaistered it. In *August*, of the same year (1789) I asked the same company; and they viewed, with surprize, my *hemp*. It was even, thick, well grown, and seven feet high. The labourers were then pulling it; and these gentlemen, some of whom were hemp farmers, declared they had never seen a better grown, or finer crop, on their best lands. I lost some of the hemp, by injudicious management; but had, I think, 2,500 weight. After the hemp, I sowed wheat; whereof I sold 110 bushels, heavy and excellent. Clover was sown on the winter grain; and I cut luxuriant crops for several seasons. The field lay for twelve years, without any other manure, save plaister; and threw up plentiful crops of grass. I ploughed it four or five years ago, in the usual way. It produced, with a slight dressing of well rotted compost and dung,* a crop of wheat exceeding the former. It is now in good heart; but I intend ploughing it, the approaching season. I have selected this little field, because the facts relating to it, are most within my recollection.

Ribbing, or bucking up furrows, in the fall of the year of fallow crops, is highly useful. Every mode should be practiced, which exposes surface to the influences of the atmosphere. No person should adventure, extensively, on any new plan, without first making

*Such manure throws up short straw and long, well filled, and heavy heads. There is no greater mistake, than that of ploughing in fresh dung for wheat. This always produces smutty crops, and long straw. It is not the less objectionable for having many advocates.

a trial on a small scale. It is certain that all soils are not proper for this operation; though more are so, than is generally supposed. Some have told me it did harm on such soils as mine; which is generally a light loam: yet, I conceive, such soils are the best, for this process. Roots, stumps, stones, &c. are equally obstructions to trenching, and the process adopted by Mr. *Kirk*.*

Mr. *David Landreth*, who was then my gardener, above twenty years ago, trenched (and none understood it better) a piece in my garden; two spits deep, with the spade. It entirely altered the nature of the soil; so that a German gardener, who is yet with me, was much prejudiced against it. He did not succeed in his crops on this ground: and it really appeared to me to be harsh, subject to bind, and crack; and the worse for the operation. I changed the crops, from leguminous, and tap rooted plants, to those of the *brassica*, or cabbage, tribe; and they succeeded wonderfully. So that this must be attended to, before a judgment is finally formed. This ground is now occupied by about one hundred grape-vines; and they thrive so remarkably, that an intelligent foreign *Vigneron*, who has been so kind as to assist me in their culture, assures me, I could not have chosen a more propitious soil.

Although I may indulge opinions deemed too favourable to the practice; I have stated what has fallen under my notice, both as to facts and opinions. I cheerfully, therefore, leave the subject to those who

*For Mr. Kirk's paper, see page 85.

must encounter the same degree of risk in the experiment, to which I was exposed.

The last harvest, I had an hundred shocks to each acre of wheat off an old trenched, small field, which was well attended; and manured, moderately, with dung and compost. It is now threshing; but uncommonly injured by *rats*. I shall have more than thirty-five bushels to the acre, under all its misfortunes. I have lost, as it now appears, one third of my crop, by these vermin.*

Belmont, February 7th, 1808.

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* On this field I have a fine, young, and hitherto flourishing orchard. This spring, I directed it to be trimmed; and have made an unpleasant discovery. The *canker-worm* (as I conceive it to be) is committing the most destructive ravages. Many of the trees will be victims; and those planted either deep or shallow are alike affected. The person who pruned it, informs me that this worm appears generally through the neighbourhood, in ruinous number, hitherto unknown; and in trees of all ages, soils, and exposures. Some orchards (he says) are not worth the price of trimming them. I observed several trees of the same kind of apple, free from the worm; and I intend to notice them hereafter. I have not heard of any remedy or preventive, or made enquiries; as the misfortune is new to me. I have seen accounts of these worms in New-York, and the eastern states. But do not recollect to have read of remedies. It would be well for the society, to promote enquiries; and obtain information upon the subject. My *Quince trees* are in the road to ruin, occasioned by these worms. A neighbour informs me, they destroy young *chesnut*, and other *succulent* forest trees. I will endeavour to find out from

March 1808, I had thirty-nine bushels to the acre; weighing sixty-four pounds the bushel: this is mentioned only to prove, that those who conceive that trenching ruins land, are much mistaken. I am convinced that if it had been threshed soon after harvest, the produce would have exceeded fifty bushels to the acre.

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whence the worms originate; by confining some in boxes or vials, to pass through their changes. I discovered in this way, the wasp from which the peach worm originates. Some other and better mode may be used, by those intelligent in such investigations. It might lead to a discovery of remedies, or preventives. They are found in the roots, body, and even in the heart of the trees. *Pear trees* are not yet injured; though many are intermixed, in the orchard, with the apple trees in which worms are found. I do not perceive them in *plumb trees*. In my old orchards I have discovered only one tree infested by the worms: this I shall grub up and burn.

Hemlock for Live Fences. By Richard Peters.

Read March 8th, 1808.

While my attention was turned to the subject of *live fences*, on a great scale, for our *fields*, it never occurred to me, that I had some of the best specimens of *hedges*, in my *garden*. These have been planted, at least *sixty four years*. I have some, planted about six years. They are composed of what is here called *hemlock spruce*, but it is the *hemlock* of our forests. It is to be found in plenty on the *Wissahiccon;* and also on the rough borders of our other creeks, whose courses run through a hilly country. The old hedges are now as vigorous, as they could have been in the first years of their being set out. They are close, strong and impervious; and never, like the *cedar*, die at the bottom. They have outgrown the dimensions within which I formerly wished to confine them; being about six feet in thickness, and five feet in height. They are clipped once a year, (in June, after they have blossomed) with the garden shears; and can be formed into any figure or shape, as was the fashion in my father's time. Balls, pyramids, arches, are here displayed, in the antiquated taste of former days. They were the acquaintances of my childhood; I keep them as I found them, and as contrasts to the wildness of nature within view of them. These hedges bear plashing, cutting and clipping without injury; and nothing of the kind can be neater, than their appearance when newly clipped. They retain their verdure, through the winter, far beyond most of

the resinous tribe; none whereof are subject to be eaten by mice, or other vermin, or browsed by cattle, as are deciduous trees and shrubs. Mine are clipped perpendicularly at the sides, and horizontally on the tops. A small part of one hedge is of *cedars;* but the appearance is gloomy, as if they were scorched; and the branches neither thick or regular, though equal pains are taken with it. The *hemlock* hedges were planted in a single row. The stocks are at distances of about one foot from each other; and were set out in the same year with very large trees, in a grove or walk near them, of the same species. The clipping has stinted them, but has not lessened their verdure, or vigour. They permit weaving or training, in any way; being hardy, pliant and tough. They grow quicker than the cedar, as I have frequently experienced; and can be raised, with little trouble, from the cones. I have enough to plant a large extent of hedge or fence, growing spontaneously under the old trees. They thrive in the shade far beyond *cedar*. I never saw any other evergreen hedge equal to one of *hemlock*. When in blossom, it is the handsomest of all its tribe. The limbs are horizontal; and grow much longer than those of *cedar*. *Layers* will strike root and fill the bottom.

My young fence looks well; but if I had sooner began to plash, cut and train it, I should have had it much closer, and better in every respect. One part has been sadly ruined by horned cattle; against whom it ought to have been protected. This young fence, I have cut down to five feet high, but it should have been kept much lower; by beginning to cut, plash and form it, after the first year. This was partially done, but atten

tion was not sufficiently paid to it. Nevertheless it has a promising, and very healthy appearance; and it has shewn that it will bear neglect. I shall dress and shape it wide at bottom, and tapering, so as to be narrow at the top; according to the mode recommended by Mr. *Main*, of George town, Potomac. The *juniper*, very common through our country, is excellent for filling the bottoms of live fences. It is hardy, prickly, grows as fast as *cedar* or *hemlock;* spreads and keeps low; and stands cutting without the least injury.

Beer quite as healthy, and much more agreeable than that brewed with the *Canada* or *Halifax* spruce, is made by the infusion of hemlock branches, with the materials of which our common spruce beer is composed. It has been substituted for spruce, for many years in my family; and we think it preferable in flavour to the *Canada* or *Halifax* spruce.

Although as a substitute for *thorn*, I prefer the *hemlock* for fences or hedges, to any other of its kind, I do not mean to depreciate the *cedar*, where *hemlock* cannot be had; the former being more generally attainable. I have planted great numbers of both; and have had the best luck with the *hemlock*. The spring is the best season for planting resinous trees; and Mr. *Taylor's* mode is superior to any other, for removing young evergreens, of any kind or description.*

* On the grounds of a college at *Oxford (England)* I believe *Trinity College*, there is a whimsical idea executed. A row of large trees are connected, by limbs engrafted. The extreme of a limb of one tree, is engrafted into the stock of the other; and have thus joined the trees on a long walk.

Utility of the Italian Mulberry Tree, and on making Wine. By Joseph Cooper.

Read March 8th, 1808.

Cooper's Point, Feb. 22d, 1808.

Respected Friend,

I received your note of 16th, two days past. I searched but cannot find a copy of the piece concerning the Italian mulberry tree, but still remain of opinion, that the bark would answer well to make paper of a superior quality, as the trees if properly trimmed will produce a great number of shoots from 3 to 10 feet long, the first summer, which may have the bark stripped off, rotted like hemp or flax, and reduced into a matter re-

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This may be tried on the stocks of *hedges*, at no great trouble or expence. If it succeeds, it will effectually guard against the entrance of horses, or cattle. On the *Schuylkill*, near *Reading*, I have seen large *Button-wood* trees thus connected. Whether fortuitously, or not, I cannot say. I have a large *hemlock*, consisting of two distinct trees, which I planted when a youth, in the same hole; and twisted around each other. They have completely embodied; and appear like one stock; save that the spiral junction can be perceived, on close examination. I have no doubt of its being practicable to connect the plants of an whole hemlock hedge, by *approach-grafting* of some of the limbs, in imitation of the *Oxford* experiment. In deciduous trees, there is more probability of success. One horizontal string of limbs thus engrafted, would be sufficient.

sembling silk, and full as soft and fine, as I formerly shewed you.*

As to the time the grape vine in my garden, was taken from the original, I cannot recollect; but think it was previously to the British army possessing Philadelphia; [1777] that vine taking so long a time to come to its present size, need not discourage persons from propagating the native grape vine, as 10 or 12 plants would cover as large a space, and produce as much fruit, in a tenth part of the time if properly cultivated. You are possessed of an account of the produce; and I will endeavour to send a sample of the wine to the Agricultural Society, and if they should coincide with me in opinion, of the practicability and expediency of encouraging the cultivation of the native grape in our country, they will address the public on the subject. I would not discourage the propagation of the best and hardiest kind of foreign grapes, yet must give the native the preference, as they are proof against the hardest winters, grow spontaneously in almost every part of our country, and are so various in kind and quality, that every person may be furnished with plants by taking them from vines that produce the most and best fruit, in their neighbourhood, by which means they will be certain of such as are adapted to the soil and climate.

A circumstance ought to be considered respecting grapes: they will produce fruit from the seed in a fourth part of the time that an apple or pear will; and from a

* Mr. William Young of Delaware, made some years since, a very good brown paper from the roots of the red mulberry tree.

cutting, as soon as a peach from the stone; as to grafting I never tried it till the last year; having a vine in my garden producing grapes not to my liking, I grafted it with the "Powell"* grape, and instead of claying, plaistered it with a composition of bee's wax, tallow and rosin; two scions grew and produced six bunches of grapes the same summer, some of the branches grew more than 20 feet in length, and the two scions have in one summer formed a top sufficient, if but reasonably full to produce a bushel of fruit.

The method I have found best for making wine from grapes, is to let them hang on the vines till fully ripe, then to gather them, when dry, throw away rotten ones if any, open the cider mill so as not to mash the stems or seeds, put the pummice (or mashed grapes) on some clean long straw, laid on the cider press floor, lap it in the straw, press it well, then take off the pummice, add some water, and after it has soaked a while press as before: the latter will make as good wine by adding sugar as is commonly done in the country, but I prefer making it of the juice without water.

The last autumn I tried several ways of making wine: one cask of 34 gallons that first run from the press, I set to ferment in its then state, expecting to make that without sugar; another of the same size had 17 pounds white Havanna sugar added, the remainder was mixed with the second pressing, and had the same proportion of sugar; the first ceased ferment-

[* This is also called the "Bland" grape, from the gentleman who brought it from Virginia, and gave it to Mr. Powell of Philadelphia.]

ing in half the time of the others: when the fermentation subsided, I drew them off, (one cask at a time) into a tub and rinsed the cask with water and fine gravel, then put in about 1-8th of the quantity, of French brandy (good apple brandy, will make the wine as good, but not so like foreign wine,) and having burnt a sulphur match, (about half as much as would kill a hive of bees) after the match was burnt out, I stopt the bung again, shook it to incorporate the liquor with the smoke, and finally filled the cask.

The first cask when racked I found too tart, I believe owing to the wet summer, on which account I added sugar as above, and the like proportion of brandy; in about a month I racked all again, and found this last mentioned cask far better and clearer than the others, from which I conclude it is best to let grape wine first ferment, and when racked, to add sugar to the palate, by which means wine may be made palatable from sweet or sour grapes.

Taking into consideration with what ease and expedition grape vines may be propagated; the great expence and uncertainty of being supplied from foreign countries, and the base and dangerous practice of adulteration by many of the venders of wine, I am induced to urge the propagation of grape vines in preference to other fruit, especially in such places as shades are wanted, as they may be trained in such manner as fancy or convenience may direct, and more speedily than any durable fruit bearing tree, and if properly trimmed and trained, will exceed the same kind of vines which grow

on trees, in production of fruit in quantity, size and flavour, beyond most people's imagination.

Your friend,

JOSEPH COOPER.

DR. JAMES MEASE,
Secretary Agric. Soc. Philad.

P. S. I make no doubt but that numbers in the U. States have more knowledge on these subjects; mine is only experimental, and undoubtedly very imperfect; therefore if the publishing any part of the foregoing, should bring such knowledge to public view it will have a good effect. J. C.

On a three Furrow Plough. By William Bakewell.

Read March 8th, 1808.

Fatland Ford, Montgomery Co. Feb. 7, 1808.

Dear Sir,

You expressed a wish to be informed of the purposes to which I apply my three furrow plough, and I with pleasure communicate the account to the agricultural society, having found it useful on many occasions, especially on my lightest soils, and such as are free from large stones or other impediments.

I say nothing of the construction of this plough, as it is described by Mr. Cartwright in the communications to the British board of agriculture; but to those who have not that work at hand, it may be necessary to observe, that it consists of three shares and three mold plates of iron, fixed in a frame, so as to follow each other at nine inches distance, by which means twenty seven inches of land are ploughed at one time. It is drawn by three horses abreast, and has two wheels to regulate the depth.

After a clover ley has been once ploughed deep, by a common plough, the three furrow plough will answer extremely well for skimming the surface, preparatory to sowing with wheat. I have sometimes used it for ploughing in the seed. I also use it on fallows to destroy weeds, and between rows of indian corn, in which case, a single plough should first pass close to the corn, and as the rows are with me eight feet apart, the three furrow plough, following the other, completes the space between two rows at one 'bout.

Potatoes may be planted in the furrow after this implement, the land having been previously ploughed and manured. The distance between the rows (27 inches) is however too small for the deep horse hoeings, which potatoes require: but for turnips, this plough succeeds admirably, and in lieu of the turnip drilling machine. I had the last season, an excellent crop of turnips, on six acres of wheat stubble, by the following method.

Immediately after the grain was cut, the soil was turned up by the single plough, to the depth of six inches: the manure was then laid in heaps on the land, and a glass phial prepared for the turnip seed, by having a small quill inserted into its perforated cork.

The first cloudy day, the manure was spread equally over the ground; the triple plough, set to the depth of three inches, covered the manure, and in the furrow, (or rather half way between the bottom of the furrow and the surface) the seed was dropped from the phial. A light roller was then drawn over the whole, in the direction of the plough.

The rows of turnips are thus 27 inches asunder, in which space a small plough, drawn by one horse, can readily pass to destroy the weeds, and to earth up the plants; the hand hoe is used to cut up the weeds, and superfluous turnips in the rows.

I have no doubt, but that on a light sandy soil, this kind of plough might be used for every purpose, even for turning over a sod. It is calculated, that in ploughing an acre, with a furrow of nine inches, the ploughman travels 11 miles; with this implement he ploughs three acres in travelling the same distance, and with more ease, for the wheels will keep this plough in the

proper position, if the ground is of a tolerably even surface.

I could have wished to state to the agricultural society, an account of the application of my turnips in fattening cattle and sheep, but not having conveniencies for weighing the cattle at certain periods, I am unable to speak on this point with any degree of accuracy; I can however venture to assert their general utility for that purpose, (of which, in this climate, some doubts had been suggested) and I hope to furnish the society with more specific and decisive information on this subject at a future time.

I remain with regard, dear sir,

Your friend and servant,

WILLIAM BAKEWELL

DR. MEASE.

On Speltz. By James Mease, M. D.

Read March 8th, 1808.

This variety of wheat is much cultivated in the middle counties of Pennsylvania, and is highly prised. In answer to some queries which I sent to Caleb Kirk, of York county, I received the following statement.

"The speltz I have concluded to send by the mail stage. Thou wishest to know the qualities of it which induce the farmers to cultivate it, I therefore inform thee, that it does much better than wheat, in flats of cold ground, not being so subject to freezing out in the winter, and I have often known it sown in a part of the field which was esteemed too poor for wheat, but whether it succeeds better than wheat in very poor land, I am not quite able to determine. One thing I am fully convinced of, namely, that it will do well in land that is too rich for wheat.* When shelled, it produced from 40 to 50 per cent: It then yields flour well, as the bran is thin. The flour is somewhat more yellow than that of wheat, and of course would not suit for merchant

* Europeans who have formed their opinions of American agriculture from the misrepresentations of British tourists among us, will be surprised at the remark made respecting land being too rich for wheat in the United States; and yet nothing is more familiar than the fact, to the farmers of Pennsylvania. In the western counties of this state, wheat sown upon such land, will lodge before maturity; and hence it is necessary to take more than one exhausting crop of hemp, or indian corn to prepare the land for wheat.

flour, although it is in all respects as good for house use, and is by many persons preferred to wheaten flour for bread and pastry, more especially for puddings. The common product when shelled, I think is about equal to wheat. Our mills have generally a pair of stones for the purpose of shelling, with a fan under the bedstone to blow away the chaff. The quantity sown is at the rate of 2 or 2 1-2 bushels per acre."

This grain is not cultivated in the immediate vicinity of Philadelphia, but its valuable properties certainly entitle it to attention. "In Thuringia, according to Dr. Willich, it is generally sown about michaelmas (21st Septr.) in stony, mountainous lands, which are otherwise only fit for oats. In France, Swabia, Franconia, and on the banks of the Rhine, it is more extensively cultivated, even in better soils. It is well known, in commerce, that the incomparable Nuremberg and Franckfort starch and flour, are solely obtained from speltz wheat. We must however remark, that this excellent grain cannot be divested of its husks by threshing, and that it requires the operation of a mill for that purpose, but it ought to be sown with the husks."*

* Domestic Encyclopedia, article "wheat."

On Draining. By Samuel Dickey. Communicated to John Miller.

Read March 8th, 1808.

East Nottingham, Chest. Co. Feb. 18, 1808.

Dear Sir,

As you have expressed an opinion that the experiment I have made in draining, might be worth communicating to the agricultural society, the following statement is at your service, to be presented, if you think proper.

In 1803, from some observations in the proceedings of the agricultural society of New York, on swamp mud as a manure, together with some accounts of the great fertility of drained swamps, in the New England farmer's dictionary, I was induced to undertake the draining of two small ones in my possession. With both I have succeeded equal to my expectations. But while engaged with these, I became so fully persuaded of the value of such kind of land, that a purchase was made of a large flat of swamp containing ten acres, adjoining my own land. It was covered with bushes, principally the different kinds of alder, swamp sumack, maple, &c. very wet in every part, and in some places dangerous for cattle to go upon. The black mud upon its surface, was from one to four feet in depth, in different places, and evidently formed through a long course of time, of decaying vegetables, mingled with fine particles of earth, washed from the ground above. The stratum next below, was mostly clay, but in some places

gravel, and clay and gravel mixed. Scarcely one place could be distinguished where the water appeared to spring up more than another: almost the whole swamp seemed to be a seep. The water flowed off in a current down the middle of the swamp. But no water passed through it, except what sprung up in it.

The first step with this ground, was, with a strong scythe to cut off the bushes. This measure, by affording a view of the whole flat of ground at once, gave a better idea of the places where the drains ought to be made. A drain quite round it was cut at the distance of a rod, and in some places a little more from the fast ground. This drain was three feet and one half wide at top, and two feet and one half at bottom, and mostly three feet deep. As the upper stratum so near to the bank, was not so deep as farther in, this drain went some depth, generally, into the clay or gravel below. The sods and earth taken out, were thrown on the outside of the drain, to be spread on the rough, uneven ground, between the bank and the drain, for the purpose of levelling it. For cutting this drain, two spades were used, of the common form, and made of the best steel; the one for cutting the extremely tough upper spitt, was kept sharp as an ax. This was easily done, as there was not the appearance of a stone in the whole upper stratum. Thus far was accomplished in the latter part of the season 1803.

In 1804 it was evident more drains were necessary. Accordingly one down the middle and two others parallel with it, (one on each side, and equally distant from the middle and outside drains) were made. These drains were nearly of the same size as the first, but the

upper stratum being deeper than at the outer drain, they seldom extended farther than through it. The swamp was now divided into long beds of about sixty feet across; some hands were set to work with long scalping hoes, broad at the edge and very sharp, to tear off the tussocks, but from a great press of other business, little progress was made that season.

In 1805, I found myself disappointed, by the ground still continuing too wet. The draining was commenced with the idea that water sprung up principally at the bank, and that it was only necessary to carry of this water by a drain, in the proper place. But the incorrectness of this opinion was now evident, as the ground along the edges of the drains only, was dry. The experiment was tried, of digging near the head of the swamp, that if possible it might be the means of giving vent to the under water, which from some cause appeared to spread itself over the whole swamp, and spring up in almost every spot. But its effects if any, were very small, as the ground still remained wet within a few yards of it. A narrower drain than the others, but of the same depth, was now made between each of the other drains which left the beds only ten yards across from drain to drain. The business of tearing the tussocks was again renewed, and the sods turned upside down to promote their drying. About midsummer they became dry enough to burn on being heaped without the assistance of any other fuel. The sods thrown out of the drains, the two preceding summers were so much decayed, as to allow their being spread) with some labour in breaking them) over the intervals between the drains. Where the ashes made from burn-

ing the tussocks could not be carted off, they were spread over the surface, and the ground thus prepared, was sown with herd grass, except a small piece which was sown with timothy and clover mixed.

In 1806, the crop was generally good, though in a number of places a little water springing up and tenaciously retained by the very spungy soil on the surface, was evidently injurious to vegetation. In other places the water had formed little subterraneous currents, between the upper stratum and the clay below, and so passed off by the drains; where this was the case, the grass was best.

In 1807, the crop was considerably better. In some places equal to any thing I have seen. Time appears to have a good effect in forming these little subterraneous currents, that convey the water into the drains, as it seeps through the clay, below the upper stratum, and as this takes place, putrefaction progresses on the vegetable matter, in the soil above, and its productiveness is in proportion promoted.

With regard to the expence, nothing accurate can be stated, as no account was kept at the time. From careful estimation, it may be safely set at about $ 25 per acre, including every thing. This is certainly considerable, but it is only in few cases, where expence to such an amount will be necessary, as this piece of ground was in every respect among the worst to reclaim I have ever seen. But in fact, a few dollars of expence are of no moment, in recovering a piece of ground, that is expected to be permanently productive, and that in a high degree, without the addition of any yearly expen-

diture. I entertain no doubt of receiving on this expence, with the original cost of the ground, which was $ 5 per acre, (a great deal more than it was worth in its natural state) not less than 40 per cent yearly. In places where the ashes made from burning the tussocks can be carted off, a part of the expence will be repaid by the value of these ashes, as a manure. I have found them little inferior to wood ashes. The most profitable application of them appears to be, as a top dressing on grass. They are of little value, returned upon the ground, whence the tussocks were taken; for if this kind of soil is only made dry, and properly prepared to receive the seed, nothing farther seems wanted to render it productive. It does not seem proper that cattle should by any means be allowed to pasture on this kind of ground, not only because they would injure the drains, but their trampling also, would too much consolidate the loose spongy soil, and render cultivation necessary to renew the grass. A kind of grass that would continue long without requiring to be renewed, would be a great acquisition. The herd grass possesses the first quality, but wants the latter. Clover, from the experiment I have made, does admirably, but we know it will wear out in a few years. From the experience I have had, I think it probable, the after growth of herd grass may be profitably fed off by sheep put up to fatten in the fall of the year. The drains are all yet open except a small one, which was covered nearly two years ago by brush being laid in the bottom, and the sods and earth taken out of the drain, spread over them. This appears as yet to answer well, and is very cheap.

and easy of performance. Whether as the brush rots, the earth may fall in and choak the drain, time only will determine.

Respectfully I remain,

Sir, your's, &c.

SAMUEL DICKEY.

MR. JOHN MILLER.

Observations on making and fining Cyder, and on Peach Trees. By Timothy Matlack, Esq.

Read March 8th, 1808.

Lancaster, 7th March, 1808.

Dear Sir,

A visit a few days ago from the reverend doctor Muhlenbergh of this borough, and a communication of a paragraph of your letter to him, for which I thank you, brings in review your letter of last fall, which came to hand when there was little probability of my ever being able to acknowledge the receiving of it.—

The error in the size of Mr. Cooper's vine* has happened on the most favourable side, and it is fortunate that it is so: for the measure, as given, is quite large enough to obtain credit. He has little reason to thank me for the publication, since it has occasioned him so many troublesome visits, from persons who sought only to gratify an idle curiosity, and he has no other compensation to hope for, than the pleasure it must afford him to see, that it has also drawn the attention of some gentlemen whose object is public improvement, and that it has tended to encourage them in their laudable pursuits.

The making and fining of cyder, so as to produce that excellent liquor in the perfection it is capable of, would no doubt be a great public benefit, and I con-

[* This alludes to a publication of Mr. Matlack's, respecting a native vine of Mr. Cooper's, which covers an area of 2877 square feet.]

fess that I once thought seriously, of publishing the observations I had made on that subject; but on considering the fixed prejudices which a performance of that kind would have to contend against; that the success depends mainly on fermentation, the theory of which, you know, is less understood than any other branch of chymical science, and consequently the great difficulty of communicating intelligibly, what little I knew on the subject in practice, I was deterred from an attempt which promised so little advantage to any body, and threatened so much vexation to myself, from the blame which want of success in those who might pretend to have followed the practice I should recommend, would perhaps, but unjustly, bring upon me. It looks very like vanity to say, that I knew too much of the matter to hope for success in the undertaking.—But, in support of this opinion and to justify it, permit me to say, that I knew there was a much greater difference in the must of cyder than would be credited by our cyder makers; and that the degree of fermentation each would bear depended on its degree of strength, and that, therefore, there was very little probability that they would succeed under any possible directions I could give: for example, I knew that a pint of Vandever juice weighed but eleven penny weights in a pint, more than rain water, when in the same season a pint of juice from Cooper's sweet russett, weighed twenty-four penny weight heavier than the same water; and I knew also that the juice of the same kind of apples differed greatly in its specific gravity in different seasons, dry seasons producing a heavier and wet seasons a lighter must. These facts led me to suppose, that its

strength depended on the quantity of saccharine matter contained in it, and that consequently its specific gravity would shew its real strength, and my practice was founded on this supposition and very generally was attended with considerable success; but, meeting with the must of the Virginia crab, so famous for its cyder, I learned that this was, at least, an exception to that principle; for its specific gravity was, as near as I remember (for my notes are in the city) rather below the mean weight of our common cyder apples; and its cyder is not below our best cyders. This taught me that there was some other principle, less open to detection, on which the excellency of cyder must depend. I however proceeded in my usual mode of fermentation, and soon found that this must had much less a tendency to extreme fermentation, than that of our common apples of equal weight; and consequently, required less judgment to restrain it than others. The importance of this fact needs no comment: It gives a decided superiority to that apple for cyder, above all others.

The cyder you mention as so much approved by the French minister, was from the Virginia crab. I think in the year 1777 or '78. Cyder being then very scarce in Philadelphia, I had obtained but a single hogshead, directly from the press, and the fermentation was conducted with more than common care, and consequently became spontaneously not merely fine, but perfectly bright, and exhibited that appearance of bounding up of small drops to the height of six or eight inches, so highly pleasing in the finest Champaign wine, without any appearance of froth on the top of the glass, and re-

tained all the delicacy of flavour which distinguishes that apple, free from the slightest degree of acidity.—In conducting this fermentation attention was paid to every change in the weather; especially where the change was from cool to warmer degrees. You will see then, how difficult it must be to give precise directions for conducting so nice a process, in a climate so extremely variable as ours, and where our best cellars are too warm, in the cyder making season, to conduct it with certainty of success in the best of them; and may conceive how reluctantly it will be undertaken by any one who has feeling enough to be careful to avoid even unmerited censure. The too rapid fermentation I have restrained, by a small quantity of rectified spirits of wine, the empyreuma or burnt taste of which had been destroyed by powdered orris root, (an ounce to a pint.) A single spoonful to a hogshead is as much as can be used with safety, at any one time, and that should be laid on the surface of the cyder when the cask is full to the bung hole.

Where no great error in the fermentation has been committed, the fining of cyder is a very plain business; but it is indispensably necessary, that at the time of fining, there should not be the least degree of fermentation; of course, it must be done before the spring fermentation commences, (which generally happens about the last of March,) or be delayed until that fermentation ceases, at which time, it most frequently has acquired a degree of acidity, that renders it not worth fining. The common staple isinglass, is, perhaps, the safest fining; about five staples to two hogsheads. It is to be dissolved in the liquor intended to be fined, after being

pounded and broken into threads. To dissolve it completely, it is necessary to beat the cyder containing it well, several times a day, for two or three days, and then to strain it through a flannel bag. The best general practice is, to pour your fining into the empty cask, and then draw off your cyder and pour it on the fining. This leaves behind, a great part of the sediment, checks insensible fermentation, and mixes intimately the cyder with the fining.—Then the cask being quite full, pour on the spirits of wine, on the surface. It will generally become quite fine and *bright* in six or eight days, and should then immediately be drawn off, and bunged up close, or bottled. But if it has not been sufficiently fermented, it will break your bottles. If drawn into casks they should be bunged close, and waxed over the bung to keep the air entirely out. To do this effectually, after the bung is carefully driven in, you must bore a gimblet hole near the bung hole, and leave it open until you have covered your bung with the cement; otherwise you will cover the bung, and leave open the small holes on the side of the bung; the warmth of the cement encreasing the quantity of the air below, will throw up a blister through the air hole, and forever disappoint the attempt to close it. The gimblet hole admitting the warm air to pass, the cement keeps its place and closes the aperture, and when the cement is cooled and hardened, the gimblet hole is completely stopped by driving a white oak square plug into it.

Another strong reason for declining the task, was, that too much is expected from cyder. The best Madeira wine will not keep with less than eight gallons of brandy in the hundred, and twelve is more commonly

used: how then, can it be expected that the juice of the apple, without aid, should stand through our summer's heat? Brandy mixes its taste with the wine, in a course of years, so as not to be perceived on the palate; but cyder exposes even the smallest mixture of the best brandy, or any known spirits, more readily than any other liquor. The concentration of cyder by frost, in our coldest weather, if it has been previously duly fermented, affords a delicate bottled liquor, that will stand for years, and improve by time; but the concentration of the must, by long boiling, renders yeast absolutely necessary to ferment it to a degree, suitable for drink at our tables; and I have never met with any, that my stomach did not complain of, after even a moderate draught of it: whether owing to its being boiled in copper vessels, or some other cause, I cannot venture to say.

On Peach Trees.

Doctor Muhlenberg requests me to give you the manner in which my peach trees are treated, and especially as it relates to the worm so destructive to that tree. This I the more readily comply with as he is a witness of my complete success, and his judgment to be relied on. This mode is, indeed attended with some labour and requires some attention; but let it be remembered, that the *price* of good fruit was fixed by the deity himself when he created man and placed him in the garden of Eden. Even then, and in that virgin soil, the condition was that he "*dress the garden and keep it*," and one may venture to say, that since then the price has never been abated.

A simple plain history of a single tree, will give you the best idea of my practice, and a comment or two will be sufficient to express my reasons for that practice where it differs from common usage.

The peach stone with others, during the winter, lay covered with earth about four inches deep, and about the 20th of March was laid *upon* the ground, on its side, and covered about two inches deep with good garden mould, in the place where the tree was intended to stand. When it rose high enough to shoot out side branches, they were cut off near to the main stem, *taking great care not to injure the leaf that stood at the base of each side shoot.* On the *preservation of those leaves* I relied for a vigorous growth in the young tree; having observed, that where those leaves were destroyed, the growth of the tree was stopped for about two weeks: whereas when the branches were cut off and the leaves were preserved, the growth was not only uninterrupted but was evidently accelerated. In August of *the same season*, a bud was taken from the Madeira free stone peach tree, and set in the young tree at about eight inches above ground.* The bud was set thus early in the young tree from a settled opinion, that a fruit bearing tree could, by this means, be procured *sooner*, than by deferring the inoculation until the next year; and it was secured by a bandage of woolen yarn capable of yielding to the growth, without bearing too hard upon the bark of so young a shoot. In four weeks, or less, the bandage was removed, to prevent its injuring the

* Later experience has shewn, that setting the bud within *one* inch of the ground, would have been more advantageous.

tree, which by a longer continuance it would certainly have done. To guard against the worm there was now laid round the tree about a pint of coarse sand, so as to cover the roots and the tenderest part of the bark.* The same care to preserve the leaves was continued through the fall, and in the spring about the last of March, the tree was cut off about five inches above the inoculation; and about a quart of the same coarse sand was put round the root of the tree, in the same manner. The shoot from the bud was treated through the next season, precisely as the original stock was treated the first season, with the same care to preserve the leaf at the base of each side shoot, taking off the side shoots, from time to time as they shot out, until the tree rose to about four feet high; and then the next four side shoots were left to grow to their full length; the centre shoot being cut off in September, and adding in the month of August, a small quantity of sand round the root. In the following spring a further guard against the fly became necessary, and for this purpose an earthen cylinder open at both ends, and about five inches wide and five inches high, was procured. In March this cylinder was passed over the top of the tree, and rested on the ground, and then filled with coarse sand, so as to cover the tender part of the bark near the ground; and the stock cut off close to the inoculation,

* The fly that produces the worm, lays its *first* eggs early in April, and the fly appears from those eggs early in August. The worm produced from this *second set* of eggs, continues in the tree until the April following, and then renews the attack.

care being taken not to wound the shoot nor tear the bark of the stock. When the heavy rains of the spring had closed the surface of the ground, it was loosened with a dung fork (made strong for the purpose and having the lines square) so as to let in the air without disturbing the roots, and this process was repeated about the middle or last of August, after the first fall rains. The spring following the sand in the cylinder was loosened with the point of a trowel, to keep it from binding too hard upon the tree; to do which with much nicety required a full half minute. From this time forward, until the tree grew too large for the cylinder, no other care was required than the usual trimming, and the breaking of the ground as above mentioned; except that the body of the tree was washed quite clean every March; sometimes with simple water, and at other times with soap suds, urine &c. as they occasionally were conveniently had; but the difference in the effect of these is not easily seen, otherwise than that the soap suds cleans the tree with the least labour; and of the importance of this difference you may judge when I tell you, that with *water only* a woman of more than fifty years of age washed for me, last spring, upwards of sixty trees in *one day.* When the air was damp, and consequently, the dirt on the trees was moist, a coarse cloth dipped in the water was put half round the tree and drawn backward and forward a few times, and continued upwards as high as she could reach. This washing has been continued at least once a year to this time, and the consequence is that the bark of the tree continues smooth as that of a young cherry tree; and the effect is the same in all the peach trees in

my garden. The cylinder was broken, when the tree grew too large for it, and from that time, every spring, about two quarts of sand was thrown round the roots, to fill up the interstice between the tree and the earth, occasioned by frost during the winter, so as to cover the tender bark of the root. And by this means it has been so effectually preserved, that there has never been a worm in it, in any part of the tree, during its existence; and this has been, generally, the case with *all* my trees. There are, however, a few exceptions that deserve to be mentioned as proof of the real efficacy of this method. I had hired a man two years ago, to renew the sand round my trees, and having shewn him what to do left him. The sand was to be brought, in a barrow, about 150 yards, and to save himself this trouble, he threw round the trees a shovel full of loam and covered it with sand, so as to deceive me, and lead me to suppose my orders were complied with.—But the first heavy rain that fell, washed away the loam and formed a gutter on the lower side of every leaning tree, so as to lay bare some of the tender parts of the root; and in *every tree thus exposed* there was a worm in a few weeks after; and there was not a worm in any other tree in my garden. To this fact there are very many witnesses; and one or two of the trees so killed, are now standing; left for the purpose of shewing the fact to those who may enquire concerning it. I am aware that the fly is sometimes found in the body of the tree; but they are found only where the bark has cracked open, so as to expose the inner tender bark, in wounds recently healed and not covered, and in the forks of the tree, where that bark has become exposed

to them; none of which circumstances happen to my trees.

All my trees are treated on the same principles, and have the same appearance of that above mentioned; and notwithstanding their vigour of growth, have borne an abundance of fruit, in the highest perfection, until last summer when peaches generally failed; and even then, I had an abundant supply for myself and for my friends, until after the 5th November. The tree above spoken of was not removed; but had it been so, it would have been transplanted in the *blossom* time after one years growth from the bud, and have been set about four inches higher in the ground, than where it grew, well watered at the time of planting and the earth then raised two or three inches above the height at which the earth had before covered it; but after that time it would not have again been watered, as I conceive the watering of trees in hot weather rots the young fibres, and does irreparable injury.

The tree of which I have given the history, is now seven years growth from the bud, it measures at nine inches from the ground, twenty three inches round, and three feet higher up, it measures twenty two and a half inches. Two of the four branches fork within a foot of the body of the tree, and the mean height of those six branches, is full twenty one feet, and they cover a space of twenty two feet in diameter; and every part of it appears to be in the most perfect health and vigour. The earth in which it stands is a red loam about a foot thick, and under it is a bed of common yellow clay. There has been a cellar dug at the distance of about two hundred feet from the tree, and there, next

below the clay, was thrown out a brown flaky earth, having the appearance of slate, in a state of partial decomposition. The situation of my garden is on the summit of the hill on which the borough of Lancaster stands, and is fully exposed to the north west winds, and the extremely cold winter before the last, injured some of the branches on the north west side of two or three trees that were most exposed; all the rest of the trees have rather an uncommon degree of health and vigour.

The grafting of peach trees has not been very commonly practised, owing to the ragging of the bark, in splitting open the stock. This inconvenience is remedied, most effectually, by cutting the bark with the point of your knife, through the outside circular bark, at least, in the direction of the cleft you mean to open in the stock. This leaves the bark smooth, so as to meet the bark of the cion as perfectly as is done in seed fruits. This may sometimes save a year in the growth of your trees, and it has this important advantage, that the cions may be brought in the winter season, from almost any distance, and be used with success in the spring.

Sensible of the great advantage to the public, to be derived from the exertions of the agricultural society, I wish the zeal of its members, may long continue to increase.

and am yours and their,

most obedient servant,

TIMOTHY MATLACK.

DR. JAMES MEASE.

On Hedges.

[*The following postscript to the paper on hedges by Mr Taylor, was not received in time for insertion in the proper place.—See page* 102.]

I have chiefly confined this memoir to the actual process of the experiment, but I will add two alterations, I purpose to make, with the reasons for them. One is, to forbear to cut off any boughs, six inches from the stem, to weave them into the hedge, as they become long enough, for which their pliancy, whilst young, is peculiarly adapted, and to confine the pruning to the object of keeping the hedge low enough, until it is sufficiently close. The other is, to manure with live boughs of cedar or pine, in place of dead stuff, having found them by far the richest manure, and that by packing live boughs in a line three feet wide, or eighteen inches on each side of the row of young cedars, so as to cover the earth completely; it is probable that grass and weeds will be smothered, the ground mellowed, some culture saved, and the growth of the plants accelerated.

Virginia, Caroline Co. Aug. 7th, 1807.

Remarks on the Plan of a Stercorary, described in the Note, Page 153. *By Richard Peters.*

Read April 12th, 1808.

Fig. 1. The sizes of the timber must be regulated by the strength required by the weight of the roof.—The posts are mortised into the sills.

Fig. 2. There should be a gang way *cleated* or stripped, for the poultry to walk on. The *pump* may be made as here represented, or as in Fig. 3. where it is elevated, to throw the drainings the higher; with shifting troughs to lead it over the heap. These ends, as far as occupied for *pigeons* or *poultry*, may be floored with oak laths, and openings left, for the ordure to drop through, Fig. 1, A for pigeons, Fig. 2, B for poultry. The space not thus occupied, may be otherwise usefully employed.

Fig 3. Is a side view, as are Fig. 1 and 2, of the ends. Carts may be loaded without entering the stercorary; and for this purpose the bars above the wall, may be made to unship at proper places. The side of the gutter, next the entrance, must be elevated with large stone on edge, to prevent leakages there. The roof may be shingled, or thatched. The dimensions or height may be fixed at pleasure, as this plan is only offered for consideration. I think if the square of the frame were two feet lower, it would be better. The sun should be excluded, as much as is consistent with the admission of air. This must be governed by the quantity of manure, likely to be contained in the stercorary.

Fig. 4. A, The bed paved something like a Philadelphia street; the walls serving as curb stones. Or

it may be formed of good sound loam or clay. To rise two feet at the centre, or crown; dripping each way to the gutters. This avoids the evil attendant on muck lying in hollows, in which the over-abundant moisture obstructs putrefaction. It is more simple than the plan of an English stercorary, with a concave bed and multiplied drains, always liable to choak.* B. B. B. gutters; two feet wide, paved with flat stone, or pitched with small pebbles; to decline or drip six inches, i. e. two inches in ten feet, gradually from the back part, to the cistern. These gutters must not be paved so as to make the angles at the walls too acute. *Faggots* should be placed next the walls in the gutters, to keep open a passage, or hollow drain. The *cistern* or well need not be deep; but must be clayed at the bottom and sides, to prevent leakages. The *pump* may be cheap and simple; made like a ship pump, with a wooden brake. A wooden spear might answer the purpose; and not be liable, like iron, to corrode, and be injured by the salts, or tartar, in the drainings.

None but those who have had the means of ascertaining it by a reservoir, can tell the loss accruing by the escape of the drainings. Above 70 hogsheads of drainings have been returned on the dung heap of a moderately sized farm, in one season. Each hogshead of rich drainings is at least equal, in efficiency, to a load of dung, as a top dressing. Here is a gain of manure, for four or five acres of ground. The loss by evaporation, caused by the sun, for want of a roof or cover, is incalculable.

*All the drafts of English stercoraries I have seen, are circular; a figure, which I think inconvenient and expensive, precluding additions.

Let those who will not incur the expence of a proper stercorary, fence or pen their dung heaps; having (as I have done profitably for many years) formed the bed in the manner directed. Let drains, leading into a clayed vat, or even a hogshead sunk in the earth, be made. The heap may be covered with a straw roof, supported by posts set in the ground. The rudest step towards the object, is better than our present mismanagement. Dung or muck, lying light, and not trodden by cattle, ferments and putrefies quickly and equally.

Cattle should be confined at nights, in summer.—When they will not feed in the day, owing to flies and extreme heat, they should be fed at night with cut grass; and their dung composted, or thrown into the stercorary. Summer dung is generally lost in the fields; being either rendered worthless by exposure, or carried away by beetles.

Plaister of Paris, strewed on the layers of dung, promotes fermentation and putrefaction; whereas *lime*, especially before it is slacked, impedes them, and consumes putrescible substances, forming with the residuum, which is *carbone*, an insoluble compound.—The *gypsum* mixed in composts is found highly beneficial, and far preferable to *lime*, which should not be admitted while the fermentation and putrefaction are in progress; or afterwards, until it is slacked. The muck should be considered only as a means of impregnating other matter, and not a dependence in chief.—Good surface mould, or common earth, thrown from time to time on the muck heap, becomes a manure; and adds to the fertilizing qualities of the dung. It

imbibes the juices, and impedes their escape; as well as prevents loss by evaporation. Those who will not erect a proper stercorary, should always cover the heap with mould, or earth. To those who adopt the kind of stercorary here recommended, the intermixture of earth, or soil, will be highly beneficial.

It is questionable, whether very old dung, reduced to its elementary basis, *carbone*, is of any use in vegetation. By far the greater part of all dung, consists of this insoluble and indestructible substance. Like coin locked up, till antiquated, it depreciates. Its value depends on its currency, and quick circulation.*

To our farmers in general, a building for a *muck heap*, appears whimsical and strange. They will find it, however, the sure and all essential means of increasing the numbers and sizes of their barns, and all other buildings. They should value it, as the miser does his strong box. *They* should grasp after and hoard manure, as greedily and anxiously, as *he* seeks for and accumulates treasure. But far different must be the results of their endeavours. This hoard of the farmer is not to be locked up uselessly. It must be expended liberally, without extravagance, for the benefit of himself and his country.

* I think dung begins to deteriorate, after it is one year old. I have put it on after lying several years, without any perceptible benefit. But the practice of ploughing in hot and fresh dung, has often been to me a subject of regret. It not only produces smutty crops, in parts over stimulated, but cannot be equally spread, or covered. So that much straw and little grain, appear in spots, which often lie down; and in others, scarcely any advantage is derived. Muck composted, will keep the longest, without injury to its fertilizing qualities. *Dung* and *muck* in confined places, from which free air and moisture are excluded, undergo a degree of combustion; and become *dry-rotten*, mouldy and worthless.

PLAN AND ELEVATION OF A STERCORARY.

Fig. 1.

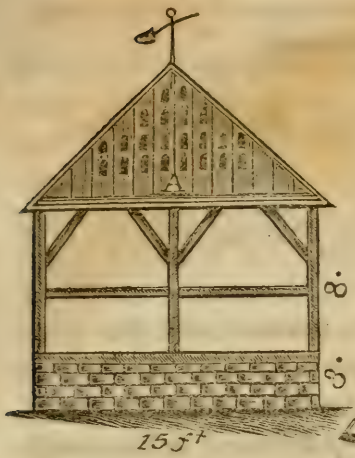
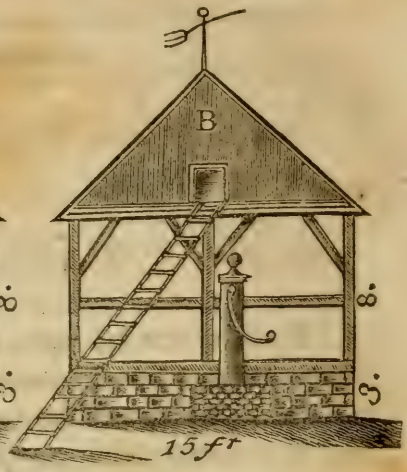


Fig. 2.



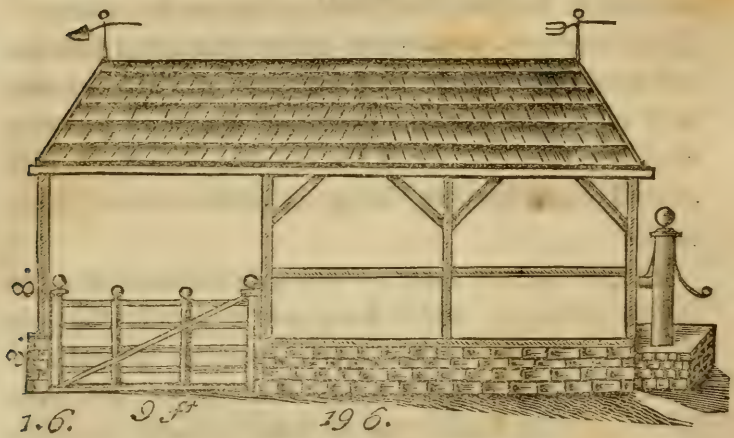
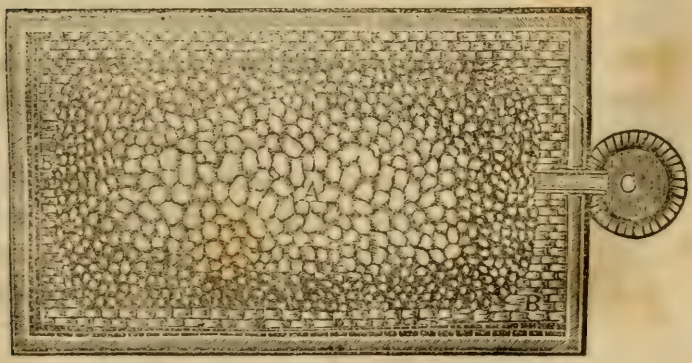


Fig. 4.



Account of native Thorns. By Thomas Main.

Read April 12th, 1808.

Near George Town, Potomac, Oct. 15, 1807.

Sir,

Yours of the 8th inst. came to hand last night. I am sorry that your request concerning my transmitting you specimens of the several sorts of the American haw thorn, which are to be found in this neighbourhood, has been deferred so late in the season.—This forenoon I went out to gather them, and find that the most of them have shed their leaves, and what they still retain, are partly in a state of decay, or so easily detached from the sprigs, that it was with much difficulty I could get any, in any tolerable state of freshness.

In this district, there are only four species. The first is the cockspur, which I suppose is equally common in Pennsylvania; of this species, there are several varieties, some with broad, large, thick leaves, and some with narrower leaves, one of them however, seems to be dwarfish, and bears yellow berries, but otherwise, the same as the rest. The second is not very plentiful, it has pretty large, round leaves, and varies also a little, almost in every plant; the third is a species of the maple leaved, and is common in various parts of the continent. There is in this sort a great diversity in the taste and shade of the fruit, some of them being very pleasant to eat, and of a light red; others indifferent, and some extremely sour, ill tasted and harsh. The

fourth sort is the species which I have named the *American hedge thorn;* it has no varieties that ever I have met with, either in the foliage or fruit. The first and the last are the only two haw thorns which I would chuse to plant for live fences, the last however, is preferred by every one that has ever seen my hedges.—Its regular growth, lively foliage, and upright aspect, determines the choice of a spectator at once. It is of free growth, extremely healthy, never infested with the plant louse, and retains its leaves longer than all the others. The plants in my nursery, are now as green as in July, I shall therefore send you some complete specimens of them, root and all, in a preserved dry state.*

I remain, Sir,

Your obedient servant,

THOMAS MAIN.

DR. JAMES MEASE.

[* The difference in the colour of the *American hedge thorn*, when compared with the other specimens, was very apparent, in those sent by Mr. Main to the society. The species named by Mr. M. is the *Cratægus Cordata* LIN.]

Growth of Thorns from Cuttings of the Roots.
By James Mease, M. D.

Read April 12th, 1808.

In the twenty third volume of the Transactions of the London Society of Arts, Mr. Taylor of Moston, near Manchester, has given an account of his success in the propagation of thorns by cutting the roots into lengths and planting them. In two years they became as good thorns as the average of those he had purchased, and planted at the time. The thorns were three years old when he got them. In April 1802, he had occasion to move a fence, [hedge] from which he procured as many roots of thorns as made upwards of two thousand cuttings, of which he did not loose five in the hundred.

The method of raising the thorns from roots is as follows.

"Purchase the desired number of thorns, and when three years old, take them up and trim the roots, from each of which ten or twelve cuttings will be obtained: plant these cuttings in rows half a yard asunder, and about four inches from each other in the row. They ought to be about four inches long, and planted with the top one fourth of an inch out of the ground, and well fastened, otherwise they will not succeed so well. April is the best time to plant the cuttings. The thick end must be planted uppermost. The advantages of this mode are, first, in case any one has raised from haws, a thorn with remarkably

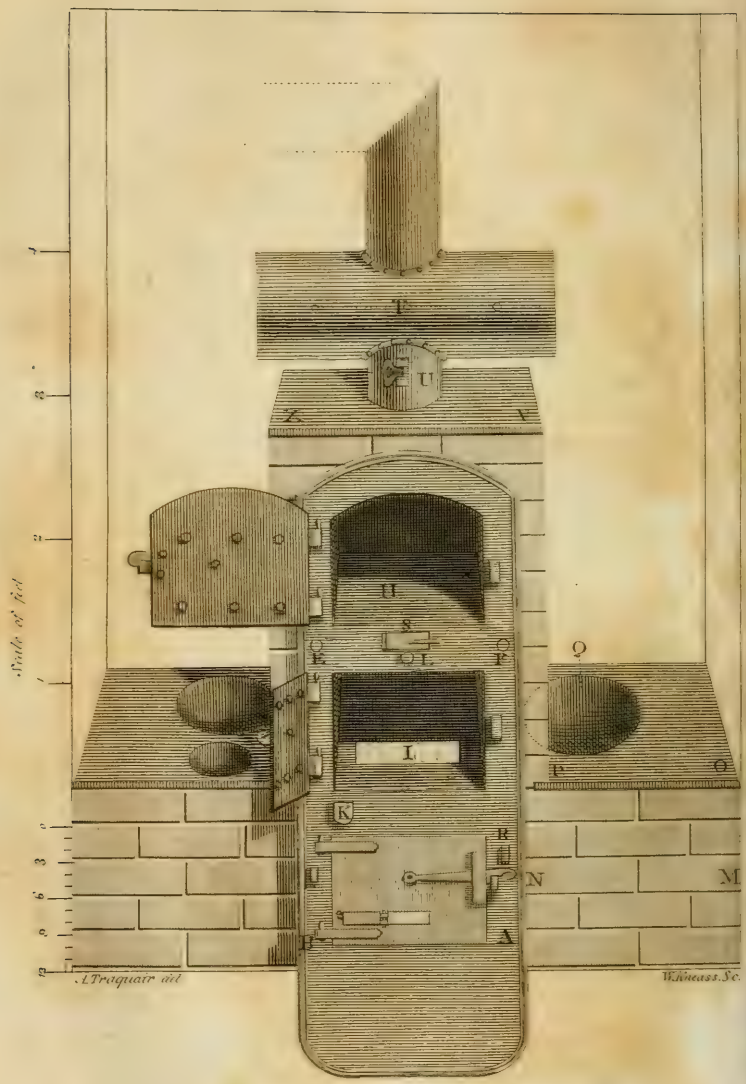
large prickles, of vigorous growth, or possessing any other qualification requisite to make a good fence, he may propagate it far better and sooner, from roots, than any other way. Secondly, in three years he may raise from roots a better plant, than can in six years be raised from haws, and with double the quantity of roots. It would not be a bad way, in order to get roots, to plant a hedge in any convenient place, and on each side to trench the ground two yards wide, and two grafts deep; from which, every two or three years, a large quantity of roots might be obtained, by trenching the ground over again and cutting away what roots were found, which would all be young and of a proper thickness."

As I knew that Mr. Kirk of Brandywine, had commenced a thorn fence on his farm, I sent him Mr. Taylor's publication, with the expectation, that the information contained in it, would shorten his labour. The next time I saw him, he told me, that the fact of the vegetation of the thorn root cuttings was not new to him, having been informed of it by his neighbour Mr. Armor, who had discovered it, when trimming the roots of some old thorns which he was about to transplant. Those cuttings being thrown carelessly under some earth, began to grow vigorously, and many of the plants were set out. He observed that those which were placed on the south side of a rail fence, did not succeed so well as those set on the north side, owing to the great heat reflected from the rails. Neither Mr. Armor nor Mr. Kirk however, follow the practice of propagating thorns in this way, as a particular species of thorn (*cratæ-*

gus cordata) cultivated by Mr. Main of George Town. Potomac, grows without difficulty.*

The editor of the "Retrospect of discoveries," London 1806, says "we have long ago practised the planting of shoots which came up plentifully from the fibres of the roots left in the ground, after stocking up white thorn hedges. We can also add that the best way of renovating a worn-out white thorn hedge, is to bare the earth, and chop off the large old stools with a sharp axe, near to, or below the lower fork of the stems: each one of whose roots will afterwards be found to throw up vigorous shoots, and much thicken the future hedge, if the same is thoroughly protected from cattle, and kept clean from weeds." These facts are highly encouraging to the commencement of hedge rows, and should induce the American farmer without delay to begin this important work. Land thus inclosed, will prove a much better fortune to the child who may possess it, than if the amount of the money which the work may cost, had been put out at interest for his account.

* To those who have it not in their power to procure plants of those thorns, which Mr. Main cultivates for sale, it will be important to know, that by sowing the haws of the pear leaved thorn, in ploughed ground in the spring, and spreading gypsum and ashes on it, their vegetation will be promoted in a most remarkable manner. The plants from haws thus treated, in one case, grew two feet high the first year.


Scale of feet
A Traquair del
W. Kneass Sc.

Description of a Kitchen Stove. By Samuel Dickey. Communicated to John Miller.

Read April 12th, 1808.

Oxford, Chester County, February 29th, 1808.

Dear Sir,

There are few subjects on which the ingenuity of man can be employed to better purposes than devising the means of promoting œconomy in the consumption of fuel. Already our cities and their neighbourhoods, feel the severe effects of a scarcity in this article. But the time is not far distant, when this scarcity will be felt in a much higher degree; and many parts of the interior country that are yet hardly affected, will suffer most of all as wood is the only fuel there attainable.—Though much has been done by the inventions of ingenious men, much still remains to be done, and particularly in kitchens, where, it is the universal complaint, that much the greatest consumption takes place. My thoughts have been occasionally turned from the direct pursuits of agriculture, to this subject, and some experiments have been made which have terminated in the invention of a kitchen stove or closed fire place, which I flatter myself may be of service to society.—To cover the expence incident to such inventions, and which cannot ordinarily be reimbursed in any other way, it has been thought necessary to secure the advantages (if any there may be) by a patent. As the encouragement of such inventions comes within the view of the association, I trouble you to present to the socie-

ty, the following account of this stove or closed fire place, with the drawing that accompanies it, which I hope will make it sufficiently intelligible.

The general principles of this kitchen stove are—

1. Enclosing it with the pots connected with it, in some covering that is a nonconductor of heat, by which the speedy evaporation of the heat is prevented, and its power concentrated more intensely upon the pots and ovens used in cooking.

2. Drawing off the fire from the furnace of the stove, through openings in the stove plates, that may be closed at pleasure with sliding dampers, and by means of the covering that surrounds the stove, conveying it round pots set close to these openings, and returning it back upon the ovens for the purpose of encreasing the heat in them.

3. Allowing the fire to pass into the oven of the stove, through an opening in the bottom plate of the oven immediately above the fire, so as to bear with all its force on a tea kettle or any small vessel set into the oven for the purpose of boiling.

4. Receiving the heat into a large receptacle of sheet iron placed above the stove, through which it may pass into the kitchen for the purpose of warming it.

The application of these principles will be easily understood from a more detailed account of the stove with references to the drawing, which presents a front view, with the pots connected, inclosed in brick work, the only covering that has yet been used as a nonconductor.

A, B, C, D, is the front plate, which on all sides projects a little over the brick work that is built nearly

close to the stove. The expanding of the iron on being heated, would move the brick work out of its place, if it were built against the edges of the plate. This plate rises about a third higher than the stove itself which reaches only from A, B, to F, E, in order to allow a second oven of sheet iron to be placed about the oven of the stove. The mouth of this oven appears open at H. The stove has but two apartments. The lower, the door of which appears shut, is the furnace in which the wood is consumed, and is similar to the furnace of a ten plate stove. The second apartment, the door of which appears open, is used as an oven for baking or roasting, or for boiling a small vessel as occasion may require. At I, appears the opening in the bottom plate through which the fire is admitted into this apartment. Over this opening a sliding damper passes when it is desired to shut it, the handle of which is seen projecting in front of the stove at K. There is a corresponding opening in the plate over this apartment, through which the fire passes out of it into the flue above. This opening is also closed by a sliding damper, the handle of which projects at L. The brick work M, N, at the side of the furnace as appears in the drawing, extends such a distance as to inclose a vacant space sufficient to contain a pot set close to the side of the furnace. Over the top of this inclosure of brick work, is laid flat the cast plate O, P, in which is an opening Q, through which a pot of a cylindrical form may be dropped close to the side of the stove. This pot is supported by a perpendicular edge projecting round the lip, and resting on the plate through which it is dropped. Directly opposite the pot is a large open-

ing in the stove plate, through which the fire passes round the pot, and proceeds in a flue formed between the brick and the stove plate up the back of the stove, and thence into the flue between the two ovens, and so proceeds up the sides and over the top of the second oven. The opening in the stove plate through which the fire passes to the pot is closed at pleasure, by a damper sliding close to the outside of the stove plate, the handle of which projects through the edge of the front plate at R. On the other side of the stove is an accommodation of brick work for another pot exactly similar to what has just been described, only as appears in the drawing two pots of smaller size may be used instead of one. At S, is a small door through which a raker may be inserted for the purpose of cleaning the flue between the first and second oven. T is the receptacle or drum of sheet iron, into which the smoke and heat is received on leaving the stove, for warming the house. When this heat is not required in the kitchen, the passage into the drum is closed by a damper turning on centers, the handle of which appears at U, and the smoke is directed in a flue in the upper part of the brick work into the chimney. V, X, is a cast plate that lies flat on the top of the brick work, for the purpose of strengthening it.

Every person who thinks upon the subject, is sensible of the vast waste of fuel that takes place in cooking at an open fire. The introduction of a ten plate stove is certainly œconomical, and adds much to the comfort of the kitchen. But still there is both a manifest expense, and trouble in keeping up two fires. One ought to serve all purposes. The stove or closed fire place

above described, does all the business of the kitchen with one fire and a great saving of fuel as the same heat that bakes and boils, is afterwards emitted to warm the kitchen with nearly as good effect, as if it had performed no previous service. Besides the saving of wood, there is perhaps as great a saving of labour, by the facility with which the cooking business can be executed. The ovens are always warm when there is fire in the stove. The fire can be turned off and on the pots in an instant, without the trouble of moving them; and the cook is never exposed to the scorching heat of an open fire. This stove is set with the most advantage in the fire place of the kitchen. The front of it extending about twelve inches out from the breast of the chimney so as to admit the apparatus for heating the kitchen to stand out in front of the mantle. The throat of the chimney should be stopped in winter, but furnished with a sliding shutter to be opened occasionally so as to allow the steam from the boiling pots to escape without incommoding the kitchen.

With much respect,

I remain yours, &c.

SAMUEL DICKEY.

MR. JOHN MILLER.

Changes of Timber and Plants. Races of Animals extinct. By Richard Peters.

Read April 12th, 1808.

In a conversation with Mr. *Rembrandt Peale*, who adds to talents promising to render him greatly eminent as a portrait painter, a knowledge of natural history, in some of its most curious branches, the subject of *changes* of *timber* was mentioned. He informed me of the circumstances attending their search for the bones of the *mammoth*, in *Orange* and *Ulster* counties, in the state of *New York*, in 1801. He was so kind as to gratify me, by presenting to me two pamphlets; accompanied by a letter, which I send for the perusal of the society. I transcribe the passage he alludes to, relating to the timber. I have been highly entertained and instructed by the perusal of these pamphlets; which I have now for the first time read. They are worthy the attention of every person, who has a desire to know and admire the wonders and stupendous works of nature. I find that great bodies of *marle* (the deposits of waters) exist in the country wherein the *mammoth bones* were discovered. The exploration and difficulties attending it, as well as the ingenuity and perseverance of his father and himself in procuring the bones, are very amusively displayed; and do both of them great honour. I perceive that some of the *mammoth bones* gave the first stimulus to Mr. Peale the elder, to prosecute his succesful endeavours at establishing a *museum* of natural curiosities; which has few rivals in any part of the world. It is in

itself highly interesting; but when it is considered that the collection was made by an individual without fortune, or any important assistance from others in the first stages of its progress, the result is really astonishing.

I shall, at some future period of leisure, draw together some facts relative to the position I have taken, that changes of race or locality, are necessary to prevent or remedy the deterioration of animals. And this with no desire to enter into controversy, or merely to support an opinion; but for the consideration of those interested in such subjects.

I shall when treating on the subject, make use (inter alia) of the following facts, furnished to me by Mr. *Peale's* pamphlet. They will shew a tendency in nature to changes, in the animal kingdom; by exterminating whole races, or species of animals, to be succeeded by others entirely different. I shall not deem it necessary to enter into delicate questions, on this subject. It will be enough for my purpose that the haunts of these extinct animals are occupied by different species.

I find in Mr. *Peale's* account, that "four animals of enormous magnitude have formerly existed in *America*, perhaps at the same time, and of natures very opposite. 1st. The *mammoth*, carnivorous. 2nd. An animal whose graminivorous teeth, larger than, and different from, those of the *elephant*, are sometimes found. 3d. The great *Indian bull:* and 4th. An animal probably of the *sloth* kind, as appears, on a comparison with the bones found in *Virginia*, and a skeleton found in *South America*, and preserved in the museum at *Madrid*." Mr. *Peale* cites an interesting memoir of M. *Cuvier* "whose researches into this subject have been indefa-

tigable and profound;" and in it, "there are mentioned no less than *twenty three different species of animals which are now extinct*, but whose existence in former ages is attested by their fossil remains; no recent production of the sort having ever been authenticated."

I copy the passage relative to *timber;* page 36 of his small pamphlet. "Many of the cavities between these knolls are dry, others are in a state of ponds, but an infinite number containing morasses, which must originally have been ponds, supplied by springs which still flow at their bottoms, and filled in the course of ages with a succession of shell fish and the decay of vegetables; so that at present they are *covered with timber*, and have been so within the memory of man. An old man, upwards of sixty, informed us that all the difference he could remark between these morasses now, and what they were *fifty years ago*, was, that *then they were generally covered with firs*, and *now with beach.* This was verified by *the branches and logs of fir which we found in digging;* many pieces of which had been cut by *beavers*, the former inhabitants of these places, when in the state of ponds. *Scarcely a fir is now to be found in the country.*"

My son Richard, who with Mr. *Adlum*, accompanied me, in 1797 or 1798, on a tour into the wilderness in Lycoming county, to view some of my new lands, reminds me that on these lands, invariably, the old decayed timber long blown down, or fallen with age, was of an entirely different species from that standing. We found flourishing *ash*, 6 feet diameter, *sugar maple*, 6 feet through; and we measured one *button wood*, on some fine rich bottoms on the waters of the *Loyalsock*,

thriving and healthy, 11 feet 8 inches diameter. These bottoms were covered with flourishing *shell bark hickory*, *wild cherry*, *white walnut*, and an immense variety of *plumbs;* though the whole country, in other parts, had no other timber than *beach*, *sugar maple* and *hemlock*; and some stately *chesnuts* on the ridges. My son also brings to my recollection, that when we surveyed the tract, called in old times, the *pine tract*, in *Northampton* county, a great number of *ash trees*, were intermixed with the present growth of *oak* and *hickory*.

With no overweening zeal; but to obtain incontestible proofs of a fact I consider, as I believe now that it is, very generally known here, though overlooked by many very intelligent men, both here and in Europe, I wrote to Dr. *Caldwell;* who is observant, and, I understood, well informed of facts on this subject. He has politely favoured me with an answer; for which he is entitled to my thanks. I send his letter, that such parts of it as apply to the general subject may be extracted. I have not ventured to give any opinion about the immediate cause. I leave my practical conclusion to the consideration of those for whom it is intended. I am satisfied that experience in practical agriculture will incontestibly prove the position; even if the means I have taken to strengthen it, should not to others, be so apparent in their application, as to me they seem.

April 4th, 1808.

Philadelphia March 25th, 1808.

Dear Sir,

In my first publication on the mammoth, page 36, you will find an observation on a species of rotation of timber, which is known to have taken place in Orange and Ulster counties, in the state of New York.—Your ingenious, philosophic and valuable application of this fact, in the operations of nature on a great scale, to the improvement of agriculture, in the rotation of crops, deserves to be supported by concurring testimony; especially as the facts which are here advanced so easily admit of confirmation.

In addition to this paragraph I need only remark, that these morasses contain abundance of *pine burrs*,* together with *the trunks and branches of wood evidently pine* (specimens of both are now in the Museum, case No. 4,) of which *I do not remember to have seen a tree growing in the neighbourhood*, and that it is only from the circumstance being so universally known by the inhabitants that it is not often spoken of.

I remain, respectfully yours,

REMBRANDT PEALE.

* This not only proves the pre-existence of a growth of *pine timber*, on the lands now occupied by a species entirely different; but it goes much farther, in support of the analogy between natural and artificial products. The "*abundance* of *pine burrs*," which we know contain the seed, found on these lands, is an indisputable evidence of there having been seed in plenty to reproduce *pine timber*, if the land had not been *pine-sick*:—to use a country phrase, applied to lands which will no longer admit of a repetition of the same kind of crop. R. PETERS.

Philadelphia April 1*st*, 1808.

Dear Sir,

That nature delights in, and actually effects, entire changes and successions in the vegetable productions of the earth, (I mean circumscribed spots of earth) is a *fact* which appears to have been familiar to the observing part of mankind, as long ago as the age of Pliny the elder. I believe, but of this I am not certain, that the same thing is noticed in the writings of Aristotle, and is even brought forward by that wonderful man, as an argument in favour of the doctrine of *equivocal generation*. Be this, however, as it may, the fact does not need the authority of any of the illustrious writers of either ancient or modern times, for its permanent establishment. It is already established by nature herself, whose authority is paramount to every thing else, and must, in the present instance, be regarded as final and conclusive. The only thing extraordinary in the case is, that at this enlightened period, any one, who has an opportunity of observing for himself, should entertain doubts of so obvious a truth. I presume it is purely for want of such an opportunity, that the Edinburgh Reviewers have taken exception at the narrative of Mackenzie. For these writers appear by no means ignorant of facts and subjects that lie within the sphere, of their own observation.

Our own country is unquestionably one of the most favourable spots on the globe, for making correct observations, and thereby arriving at truth on the present subject. The country being new, the progress of clear-

ing and cultivation cannot fail to make material *changes* in the climate, the general state of the atmosphere, and the soil. These changes naturally and necessarily lead to corresponding mutations in the productions of the earth. For, in my mind the productions of the earth are *the native children of surrounding circumstances.*—By some, I well know that this sentiment is reprobated as profane and *atheistical.* With me, it is not so. I deem it perfectly compatible with the existence and the attributes of a God, who framed and governs the universe, as the *cause of causes*, and not as the *immediate* cause of every petty event. Viewing the Deity in this most honourable and exalted of all possible lights, I cannot but believe, that he has imparted to the earth and other elements *a power of peopling themselves*, (at least under certain circumstances) without his direct and proximate agency.

In the countries of Europe, where a more advanced stage of agricultural improvements has given a greater stability to the state of the soil, the atmosphere, and the climate, we can readily admit, that nature does not now make such frequent and striking changes in the vegetable productions of the earth, as she probably did some centuries ago, or as she does in the United States at the present time. This circumstance may perhaps, explain to us, why many Europeans, even of the most extensive observation and expanded intellect, are entirely ignorant that such changes ever occur. Men cannot incur blame for not being acquainted with facts which they have never had an opportunity to learn.—But there exists no apology whatever for the ignorance of Americans on this subject. The mutations here re-

ferred to are daily occurring before our eyes, and the fact ought to be familiar to every one of us. Indeed I thought till lately that this was the case, and that it is not so, must be attributed either to an entire want, or to a very culpable inaccuracy, of observation.

Though never practically devoted to agriculture myself, I passed my time, till my twentieth year, in an agricultural and a new country. As the vegetable productions of the earth were always objects of more than common admiration and amusement to me, my acquaintance with them began at a very early period of my life. As to the point which constitutes the immediate subject of this letter, the progress of my observation was as follows.

When my father and other neighbouring farmers contemplated the clearing of a tract of land for future cultivation, it was their custom, during the mild weather of winter, to grub up the underbrush and throw it together in what they called *brush heaps*. The large timber was afterwards felled, cut into sections of ten or twelve feet long, and rolled together in large piles called *log heaps*. Towards spring, when the timber had become somewhat dry, these *brush heaps* and *log heaps* were set on fire and consumed. During the course of the succeeding summer, I frequently, indeed almost uniformly observed, that from among the ashes of these piles of wood, there sprang up certain *new plants*, which were not to be found, in any part of the surrounding country, except in similar situations, where they had also made their appearance, in the same *spontaneous manner*. The botanical names of these plants I do not recollect, perhaps I never knew them. I well remem-

ber, however, that they were generally of a rapid and luxuriant growth. I further recollect, that at least, some of them were lactescent plants. They always appeared to me in the light of *new productions.*

It sometimes happened that the land, after having been cleared of its underbrush and forest timber, was not put under actual cultivation for two, three, or four years. In this case it never failed to produce, during the second or third summer, a crop of *white clover*, although not a sprig of that vegetable grew within many miles of the place. This fact occurs not only in Virginia and North Carolina, where I have myself witnessed it, but also as I am well informed, in many other parts of the United States. Indeed its existence can be as well authenticated as the existence of the Allegany mountain or the Chesapeak bay.

In other parts of North Carolina, where the growth of timber consists almost entirely of oak and hickory, if this be removed, it will be succeeded in a few years by a general and plentiful crop of young pines. Nor is it necessary to the success of this experiment, that the place cleared should be in a piney neighbourhood.—The event will take place with equal certainty, though there be not a pine within many miles.

During the time of my residence in North Carolina, as the farmers generally possessed large bodies of land, they seldom made use of much manure. When the soil of one field became exhausted, instead of manuring and renovating it, their common practice was, to turn it out to lie fallow for many years, and to proceed to the clearing of another field. In this case the exhausted fallow ground never failed to produce sooner

or later, a plentiful crop of a lofty gramineous plant, called in the common language of that country, *broom grass.* Nor was it necessary that this plant should be previously growing in the neighbourhood. It appeared to be the native growth, of an exhausted and an exposed soil: and from such a soil it seemed to spring without the intervention of specific parentage.

To the truth of the foregoing facts, I can testify in person. They have been familiarly known to me from my early years. Of many other similar facts I have received such well authenticated accounts, that I cannot for a moment doubt of their truth. The following one I believe, to be well known to many of the most respectable inhabitants of New Jersey.

Certain tracts of that state are covered entirely with forests of pine. If these be cut down, and the land not put immediately under cultivation, they are succeeded in a few years by a plentiful growth of young oaks.—I am told that in some parts of New Jersey, nurseries of young oaks produced in this way are to be found in the centre of extensive forests of pine. I will not vouch for the truth of this fact. All I can say respecting it is, that I received it from a very respectable source, and that it perfectly comports in principle with what I have myself seen.

In the course of the last century, the white pine sprang up spontaneously in a place called Duxborough, in the state of Massachusetts, without having been previously a native of the neighbourhood. Between twenty and thirty years ago, there was a man still living who had a perfect recollection of the first pine that ever made its appearance in the township; whereas, at present, that

plant constitutes one eighth part of the timber of the place. Though I can give no personal testimony in support of this fact, I notwithstanding believe it to be true.

In new settlements in the southern states, and I presume the same thing occurs elsewhere, the weeds and gramineous plants which gradually and imperceptibly introduce themselves into cultivated farms, are entirely different from the native productions of the surrounding country. This is a fact which is familiar to every one. Now the question very naturally presents itself, *whence are these various plants derived?* Are they introduced by man or his domestic animals from foreign places? If so, from what places, in what manner, and for what purpose? These are points worthy of consideration, and, in my opinion, difficult of solution. For my own part, I cannot hesitate to believe, that these plants are a *new and spontaneous* production of the farms where they appear; and that they are brought into existence by the new order or state of things, introduced into these farms by the instrumentality of clearing and cultivation.

Were it necessary to the purposes of this letter, I could produce numerous instances of similar innovations in the animal kingdom. But as these innovations, though remotely, are not proximately connected with agriculture, I shall forbear to swell, by dwelling on them, a communication in which I have already too far trespassed on your time, and I fear on your patience.

Before concluding, however, suffer me to remark, that though we have both been in search of similar facts, I suspect we have been collecting them for dissimilar

purposes. You have in view the establishment of a great practical principle in agriculture; I, the establishment of a mere theoretical principle in philosophy. In this respect you tower above me. For good works are greatly superior to abstract thinking, how correct soever such thinking may be.

If the preceding facts and observations, sir, can be of any avail in the promotion of your very laudable and and important views, I shall feel happy in having aided you in so good a cause. Agriculture forms the true basis of our national prosperity. Its enlightened and industrious patrons and promoters, therefore, are justly ranked among our soundest patriots.

Suffer me again to apologise for the length of this letter, and to assure you of the sincerity, with which I have the honour to be

Your obedient and

very humble servant,

CHARLES CALDWELL.

The Hon. Richard Peters, Esq.

I add the following letter as a close to the subject. Facts similar to those stated are known, wheresoever my enquiries have been communicated. Many instances of *pine* succeeding *oak* and *hickory*, and other timber, are well attested Several such facts are within my own knowledge.

RICHARD PETERS.

Dear Sir,

In compliance with your request I will now state a fact, the occurrence of which I thought had been of such notoriety that no one could possibly dispute it, until you mentioned to me a few days ago, that some gentlemen had thought you even chimerical in supporting it. For some years past I have been in the habit of visiting some estates which belong to our family, in the county of *Cape May*, *New Jersey*, and have remarked myself, and heard it as a common fact, that wherever the *pine* timber is cut off, *oaks* invariably and *hickories* very frequently will spring up, and this is also the case where the timber has been taken off by fire; the hunting grounds, which lay in the upper part of *Cape May* and lower part of *Cumberland* counties, are set on fire very frequently, in the spring, to burn the under brush, to facilitate hunting in the autumn; and although the timber is altogether pine, yet no pine springs up after the burning; while oaks and hickories invariably do. On the *Penn tract*, lying a few miles below *Bridgetown* in *Cumberland* county, there have been for several years straggling settlers, who have taken possession, and cleared some parts they have tilled; and other parts have suffered to grow up. Nearly the whole of this tract was *pine timber*; and wherever it has been cut, *oaks* and *hickories* have grown up; and for several miles along the post road which runs through it, I have seen *black oaks* stripped of the bark (for the purpose of tanning &c.) where I have been credibly informed there was nothing but pine timber a few years since. If my statement of this well known fact will be of any service

to you, you have my free assent to use it as suits your purpose, and in conclusion will observe that I am convinced, there is not a man of any observation in the counties of *Cumberland*, *Gloucester* and *Cape May*, but will confirm what I have mentioned.

with great respect

I am dear Sir,

your obedient servant.

THOMAS F. LEAMING.

RICHARD PETERS ESQ.

Gypsum; whether it is found in the United States?
By Richard Peters.

Read April 12th, 1808.

Sir,

In my communication upon the subject of *gypsum*, I mention, that "I have not been able to discover any *quarries* of *gypsum*, proper for husbandry, in this or any other of the United States. There are, in a variety of places, gypseous substances," and I may add, *fibrous gypsum*. I beg this to be understood as confined to my own knowledge; without impeaching that of others. In your publication, entitled "*A Geological Account of the United States*," page 408, several instances are mentioned of *gypsum* discovered in sundry places; and the authorities for the facts are cited. Specimens have been, at different periods, shewn to me, as being *gypsum*, and great expectations were formed concerning them. They for the most part turned out to be either a species of *alabaster;* or *lime stone:* or, if really *gypsum*, not likely to be profitably used in agriculture. The former is a gypseous substance, being composed of the vitriolic acid and calcareous earth. But it is not the *gypsum* which we find so pre-eminently useful. The *alabaster* is found in this and other states, in many places; and has no doubt some properties promotive of vegetation. But I have not made any experiments with it. Some of it was discovered in digging the proposed canal from *Norriston* to *Philadelphia*. Some *lime stone* of uncommon appearance, at or near *Dill's* or *Eickelberger's* tavern, on the great road from *York* to *Carlisle*,

was believed to be *gypsum;* but experiment soon discovered the mistake. There is there a fine body of *marle;* which I have tried by the common tests. It lies neglected in a country much in need of it, because some injudicious attempts have been made with it. One failure is enough to terrify most farmers; many of whom have yet to learn the peerless virtue of perseverance in laudable pursuits.

Wishing to ascertain whether the kind of *gypsum* in common use, existed within the United States, I listened to all information I could obtain on the subject. I mistook the name of the river where I say "it is found on the *Altamaha.*" I should have said--the river *Alabamo.* I wrote to *Daniel Clark*, Esq. of *New Orleans* for information; knowing that no person could give it to me with more certainty. He has been so obliging as to write to me, in answer to my inquiries, as follows:—

"I have been informed by persons worthy of credit, that a cliff of *gypsum* skirted the *Alabamo* river, for nearly the extent of two miles. The *Alabamo* and *Tombigbee* form the *Mobile* river; but I cannot precisely say in what place the cliff is. I have myself seen various specimens of *gypsum* taken from some lands I own on the *Ouachita* river, a few miles west of the *Mississippi;* and it is the general belief that there is an immense quantity of it there, extending, as it is believed, for some miles. This fact is well known at *New Orleans*, where the *gypsum* has been frequently made use of. I know nothing of the *marble* in that quarter." He also informed me in conversation, that a person who had seen the rocks of *gypsum* on the *Alabamo*, on both sides of the river, told him they were of vast height; and

that the river appeared, by sundry circumstances, to have once ran over them, in a cataract of great elevation. The stream, or some convulsion, must have forced a passage, which is now navigable. The expence and difficulty of transportation, forbid much expectation of benefit to *us*, from this discovery.

I have always been desirous to be assured, that we could obtain among ourselves, a substance become so essential to our husbandry; and not remain liable to the caprice of other nations for a supply. I am not, however, over anxious on such subjects. It is a wise arrangement of providence, that nations should depend on each other for supplies for natural wants, comforts, and even luxuries. This promotes intercourse and interchanges; which bind them by the most durable ties—interest and necessity. An agricultural and commercial country, should be the last to complain under this dispensation. Enquiries and explorations, for discovery of this valuable commodity, are nevertheless well worthy the constant attention of our society; and of all others engaged in similar associations to promote the prosperity of our country.

I have procured from an authentic source, an account of the quantity of plaister imported into this port in 1807. This was originally obtained from *Nova Scotia*, though much of it was brought coastwise from *Passamaquoddy*, *Portland* and *Boston;* and amounts to *fourteen thousand* tons. From this State, all the improvement produced by *gypsum* originally emanated. It affords to me peculiar satisfaction, and should be an encouragement to all who begin agricultural experiments, however discredited or novel, to look back on

the small beginnings of which I have given a detail; and contrast the present amelioration of our husbandry, with the situation of our agriculture, when the use of this substance commenced. What quantities of *European* plaister have been imported here; or how much of the gypsum has been brought into other states, I have not been able, with any degree of accuracy, to ascertain.*

* It will appear in a former communication, that the first important application of the plaister was made, several years before the revolutionary war, on a city lot, by Mr. *Barge.* In the country, I began with one bushel: and a few bushels had then been strewed to the northward of the city. When the 20 tons, mentioned to have been brought as ballast by Captain Falconer, were procured and ground, I strewed part of it over about five acres. This appeared a bold effort; and by many it was deemed fanciful and nugatory. The effects were the more surprising, as they so decidedly contradicted all forebodings of failure. The increase of this operation in husbandry has now arrived at such extent, that at two bushels to the acre, 175000 acres may be fertilized by one year's importation into this state. On an average, a ton pulverised produces 25 bushels. Some grind it closer, so as to produce 30 bushels to the ton; but this is in favour of the seller, and prejudicial to the farmer. Some strew three bushels, more two, (and others one bushel annually) to the acre. But as two bushels are most generally deemed sufficient, the calculation was made on this quantity.

The European plaister imported, is not included, as the quantity could not be ascertained. What is used in the arts and manufactures will not amount to the quantity of European plaister brought here.

It is believed, by those who have attended to the subject, that the quantity used in agriculture in other states, added

It appears in professor *Barton's* Medical and Physi-

to that imported here, will annually amount to 20000 tons. With this quantity 250000 acres may at this time be manured. The immense advantages derived in a long course of years, by the progressive use of the plaister, may be conceived, to be of great magnitude, but cannot be accurately calculated. To say that by a process begun on *two* acres, *two millions* of acres have been ameliorated from the beginning of its application, would not perhaps be extravagant.

These circumstances are mentioned to encourage experiments, and persistance in applications of substances likely to become useful in husbandry; without regard to prejudices or partial disappointments. Who can now tell, whether we may not have among ourselves, some substances, perhaps passed over every day without notice, which may turn out as wonderfully productive and useful, as the plaister is now indisputably proved to be? And these may be as little believed in, or supposed as little likely to succeed, as the *gypsum* originally appeared. R. P.

Since this communication was put to press, I am informed by a friend who lately conversed with professor *Barton*;—

That the Doctor "had lately received a letter from his brother in *Virginia*, stating that genuine *gypsum* has recently been found in three different parts of that state. In two of these places, however, the Doctor has already hinted that he believed it probably existed."

In his oration (page 56) delivered before the Linnean Society on the 10th of June, 1807, he says, "That important substance, *gypsum*, or plaister of Paris, is now known to exist in varions parts of the United States. I have found it in great abundance at the Falls of *Niagara*. It is likewise found upon the same slope, at the Falls of the *Jenisseia* river; and

cal Journal, Vol. I. that *gypsum* is found upon one of the head waters of the *Staunton* about 25 miles from *Fincastle*, in *Virginia:* on the 9 mile creek, or outlet of the *Owasco* lake. Also at the falls of the *Genesee* river; and at the falls of *Niagara* on the *Canada* side.

According to Dr. *Mitchell*, it is found at *St. Mary's* between the Patuxent and *Potomac* in *Maryland* and in the town of *Marcellus*, in *New York*. *Fibrous gypsum* is found in great quantities near *Lexington* in *Kentucky*. Whether this substance has, in any successful experiments, been applied in agriculture, or to what extent, I am not informed.

I am, Sir,

your obedient servant,

RICHARD PETERS.

April 12*th*, 1808.

DR. JAMES MEASE,

Secretary Agric. Soc. Philad.

I have received fine specimens of it from the outlet of the *Owasco* lake, in the state of *New York*. No doubt large quantities of this substance, will be found among the lime stone of our country, particularly, perhaps, in the counties of *Lancaster* and *Dauphin* in *Pennsylvania*. And in the great valley of *Berkley* in *Virginia*, where, along with the common carbonates of lime, we discover immense quantities of cubic *Pyrites*, and *Pyrites* in other shapes."

If these actual discoveries, or the conjectures realised, should be productive of the *gypsum* proper for agriculture; the countries distant from the sea board will receive a most valuable accommodation. For us, we must still depend on the present sources of supply.

POSTSCRIPT.

As this may probably be the last time I shall trouble the society on the subject of the *gypsum*, I take the occasion to mention, that *Judge Washington* informs me of his having strewed the plaister with success on his grass grounds, in other parts of the *Mount Vernon* farm, than those on which General *Washington* had failed. These parts are high and mixed with gravel. Mr. *Lawrence Lewis*, who holds part of the Mount Vernon estate, has lately perceived a luxuriant produce of white clover on corn hills on the low lands, which, had in the general's time, shewn no signs of being benefitted by the plaister put on by him, and which now operates, though applied many years ago. It will be seen in a note, in my collection of facts in 1797, that the general informed me of his failures, in every mode taken by him to use the gypsum on his fields, especially on the low lands.

No plaister was sown in *England* or *France*, though it was strewed in *Germany*, before its use was extensive, and its efficacy proved, in *America*. We have thus made some return, for the agricultural information received from *Europe*.

R. P.

Observations on the Pea Fly or Beetle, and Fruit Curculio. By William Bartram.

Read July 14th, 1789.

The pea fly, *Bruchus pisi*, is a small beetle of that kind which we call wevel, but is more than twice their size, of an ovate form and brownish colour, particularly their upper side or elytron, which is uniformly besprinkled with specks, and strokes of a light colour, as likewise the back or upper part of the thorax, near the suture or joint. The bill is short, depressed, and armed with a hair of serrated forceps, the under side and legs are black, or of a very dark, dusky colour, the femora are armed with a sharp tooth, or acute projection at the knee joint, and the whole insect is covered with fine hair.

They feed when in the caterpillar or grub state, on the green garden or field pea, as soon as the pods (legumes) have arrived to a state of maturity, sufficient to shew the peas which are within them: in the evening, or on a cloudy day, the female deposits her eggs on the outside of the pods, these eggs or nits soon hatch, and the young larva or worm eats directly through, and enters the tender young pea, where it lodges, and remains feeding on its contents, until it changes to a chrysalis, and thence to a fly or beetle, before the succeeding spring, but do not eat their way out until the colds and frosts are past, which is about the beginning of April, when we generally begin to plant peas; and if they should open a door they do not choose to leave their

old habitations until the peas are planted, unless the peas are purposely exposed to the hot sun beams, when most of them break through, creep out and fly off, and conceal themselves under proper shelter, from the arid heats of the noontide sun, and chills of the night, until the new crops of peas are ripe enough to invite them forth to the active scenes of life, as well as to fulfil the duties enjoined them by the author of creation, to increase, and multiply. After they have disseminated their eggs, they perish; scarcely a pea amongst a thousand escapes them.

But that which is surprising and difficult to account for, is, that the worm leaves the *rostellum* or sprout untouched or at least uninjured, for almost every pea vegetates and thrives vigorously, notwithstanding the corculum* and plumula seem to be consumed. Whether the sprout is of a disagreeable taste to them, or of a noxious quality, or whether they are apprised of the evil consequence of destroying the sprout, which in the end, would exterminate the race, and thus by a wonderful continence and perseverance in rectitude, set us an example of virtue, worthy of imitation, I know not. The pea fly is a troublesome, mischievous insect, for although they do not destroy the green pea, or diminish its quantity or nutritive qualities, yet it certainly contaminates and renders them disgustful to a delicate palate; for when a fine dish of them is served up, we know there is a

* Corculum is the rudiment of the young plant. Plumula is the first apparent expansion, of the infant plant upwards, which appears above ground, after the seed or pea has sprouted.

maggot in every one, the morbid speck sufficiently betrays it, though yet so small, as scarcely discernable with the assistance of a microscope, and perhaps whilst the peas are very young, do not lessen their native peculiar delicious taste; but when they are full grown, the latent evil becomes too apparent, and when quite ripe, there is little more than the fair superficial appearance of a pea, a mere shell enveloping a fat chrysalis.

I can suggest no method of destroying this voracious insect, unless the planters who suffer by their ravages, would consent to consume in the autumn, of one and the same year, all their peas when dry ripe, by feeding them off to their cattle, and import a new stock of seed from Europe. The method would, if not exterminate them, at least diminish their numbers, for in the autumn there is not one alive but the young rising generation, in the bowels of the peas which would individually be cut off by this process.

I believe these insects, since the importation and cultivation of the green pea from Europe, have avoided every other kind of vegetable and confined themselves entirely to this, on account of its superior delicacy.—They do not meddle with any of our native pulses, that I have observed; such as the caravances, dolichos, phaseoli, lupini, vicia, &c. yet there is in Carolina, a smaller yellowish species of this insect, which is, if possible, more numerous and voracious; they are destructive to all kinds of esculent legumes, particularly so to all species of caravances, and these, in the manner of the common little black wevel, lay their knits on the dry peas, which hatch and propagate continually, the year round, and devour perpetually while there is a pea remaining

for them. The common black wevel (curculio piceus) in Carolina and Florida, are particularly destructive to the mayz, (indian corn) and oryza (rice) after it is divested of its husk, and prepared for exportation; then there is no way of saving it, not even in casks, for any length of time, but is entirely safe in the husk, or in the rough, as the planters term it.

Curculio oblongus rufo-testacius, Coleopteris angulato tuberculatis notatis, proboscide longa, deorsum arcuata.

This insect is of the genus we call wevel, but is much larger than the common black one which infests grain in our granaries. They are of an oblong form, and of a brown testaceous colour, yet varied with spots or clouds of yellow or white, and the elytron or shell which covers the wings, is studded with pointed tubercles, as are the thighs, legs and thorax. The proboscis is truncated, and terminates with a serrated or toothed forceps, with which they gnaw the green fruit: near the extremity of the proboscis, are two articulated antennæ, the eyes are placed near the base or origin of the proboscis; the legs are six in number, two of which are placed on the thorax, near the joint, and the other four are on the sides of the body near the abdomen; the whole insect is covered with hair.

This is the mischievous insect which destroys all our stone fruit, plumbs, pears, nectarins, cherries &c. and I believe apples, the European walnut, and other fruits. But it is not in the fly or beetle state that they

do this mischief, but in that of the caterpillar or worm. In the spring when the young fruit is about half grown or younger, the female is furnished with a sharp spatula or gauge at the extremity of her abdomen, somewhat like the point of a lancet, with which she pierces the rind of the tender green fruit, at the same instant depositing an egg or knit just under the raised cuticle of the wound, which is like to that made by the nib of a pen. This egg soon hatches, and the little larva immediately eats inward, descending to the stone or kernel of the fruit, round about which it feeds, between it and the pulpy rind, or enters the kernel, which is yet very tender and delicate; but in this last circumstance, the destroyer generally falls a victim to his own intemperance and gluttony, for such fruit generally drop before they are half ripe, and consequently before the metamorphosis of the grub, but such as feed only on the interior pulp round about the stone, continue on the tree until the ripening of the fruit, and thus live out their time. When the fruit drops off, the worm creeps out, enters the earth, and the following spring becomes a beetle or curculio. About the time of the setting of the young fruit, they creep out of the earth, ascend or fly into the trees, copulate, and are then attentive only to the work of generation.

Such is the prolific nature of this insect, that each female lays many hundred eggs, and a few flies are abundantly sufficient to destroy the fruit of a large tree.

Many methods have been thought of and practised to remedy the evil, but none have as yet been attended with success, perhaps through want of perseverance.

During my travels southward, (from Pennsylvania to Florida,) I had sufficient opportunities to observe that

the fruit trees on the sea coast and brackish water, were free from the ravages of this destructive insect; this suggested to me an idea, that the saline vapours were pernicious to them, and hence I imagined, that if we were to go to the trifling expence of showering our choicest fruit trees with a weak solution of common sea salt, once or twice a week, it might answer the same end of preserving the fruit, and by persevering farther in a little more expence, in extending the same care to our orchards, we might in a few years expel them. But this is only a conjecture, having never made the experiment.

[January 1808. The foregoing paper being found among the papers of the society, was sent to Mr. Bartram for the purpose of revision, and to enable him to add such additional facts, as might have occurred to him. He returned it with the following note.]

"I have nothing more to add, but that the spring following, I put the experiment of showering a plum tree on tryal, with a weak solution of sea salt dissolved in water, but being too strong of salt, most of the leaves and fruit fell off in consequence of it, otherwise the experiment might have produced the desired effect, as what fruit remained were not touched by the insect, though small and disfigured by the strength of the brine; yet a few arrived to their natural size and ripened, so that I am induced to believe, that with care in tempering the solution, it will be found to be the best and cheapest remedy against the ravages and encrease of those pernicious insects yet discovered. It should be so weak as just to taste of salt.

I have lately reason to recommend fresh oyster shells, pulverized in the manner that plaister of Paris is prepared for manure, put about the roots of peach and plum trees &c. as effectual in keeping off the peach *Zygæna*, and also *Cerambix* which destroys apple trees.

Quere, whether oyster shells powdered, would not be found to be as good a manure, as plaister or lime? perhaps more lasting, and less expensive as they could be prepared with less labour and expence."

W. B.

[☞ Although we are under the necessity of closing our present Volume, we cannot withhold the following *memoir* from our valuable correspondent *John Taylor* Esq. of *Caroline*, *Virginia*. A boldness of design, and spirit of execution, mark the undertakings of this intelligent agriculturist; whose means are fortunately equal to their accomplishment. Our views are to invite and promulgate information from others; under a conciousness that we shall thereby serve the interests we wish to promote, far better than by any efforts we of ourselves are capable of making. The subject is of the first importance; and has been seldom discussed. It is hoped that this publication of Mr. *Taylor's* ideas and practice, will invite others to communicate their thoughts and experience. We have received some theoretical observations, in some points, similar to those in this memoir. But we have postponed them for the present, as we prefer actual practice, in all cases. They will be noticed hereafter, if this our first essay to revive and extend the usefulness of our Institution, meets with the assistance and encouragement, essential to warrant a continuance of our well intended endeavours.]

Memoir upon Clearing Land. By John Taylor, Esqr. of Caroline, Virginia.

The objects to be kept in view are profit and improvement. These will comprise the speediness and amount of income, the effectiveness of labour, the preservation and improvement of land, and the saving of wood and timber.

Whatever will bring most land, in the shortest space, under cultivation, will contribute to all these ends. It expedites and increases income. It extends the

powers of labour to their utmost degree. It opens a sufficiency of land for the introduction of improvement, by rest, successive crops and meadows, before a part is exhausted; and it saves the wood and timber devoted to destruction, by a necessity for cutting down new; to supply the place of exhausted land, during a slow course of clearing.

If a tract of 400 acres, would, in its most perfect state, consist of 300 in fine heart and cultivation, and of 100 in wood and timber; the more rapidly it can be brought to that state, the better. If 30 years are employed in clearing the 300 acres, it will never arrive at that state. Much of the land will be impoverished by severe cropping for want of room, and at the end of thirty years, the hundred acres reserved for timber and wood, must be invaded, to compensate for the land destroyed. Nor can the profit of labour be considerable during the whole period, because it will be partly lost for want of room, partly by the cultivation of weak land, and partly by the annual expence of clearing ten acres, Whereas an instant reduction of the 300 acres to a state fit for cultivation, would place within the reach of the proprietor the most perfect system of culture, in respect to the speediness and amount of income, the effectiveness of labour, the improvement of land, and the preservation of wood and timber.

Therefore the most powerful, is probably the best agent to employ in clearing land. No agent operates so powerfully on wood, as fire. Julius Cæsar has, I think, commemorated its usefulness towards the object under consideration, in his account of the ancient inhabitants of Britain.

The residue of this Essay is a Detail of Experiments.

Woods are cut down in June, July, August or September, and not in the winter, unless they consist of pine or cedar. Because wood is then softest, the leaves drying on the boughs are fuel for the subsequent fire, and the wood will become dry enough for burning by the following fall or spring.

The labourers cut in pairs, each pair taking a breadth of twenty yards, and working either to right or left, that distance asunder. This, with invariably falling the trees backwards, whenever they will so fall, prevents danger, and mutual interruption. They cut down all trees and bushes, working together on the opposite sides of trees large enough to admit it, for the sake of the emulative or musical invigoration arising from an alternation of strokes. Not a bough is cut from the trunk, or a grub taken up. A man will cut down ten times as much land in this mode, as he can clear in the common way; topping, cutting up trunks, grubbing, and collecting and burning brush.

The woods thus cut down, first lying until they are considerably seasoned, are burnt during the same fall, or the following spring, after the buds appear, during dry weather and a brisk wind; and produce a fire which kills nearly all the small stumps, and most of the large; and consumes in a few minutes, should the ground be well covered, every thing except large logs; many of these will burn up, and the few which are left, being seasoned and roasted, are easily burnt by collecting three or four together. If rails, wood, or timber, are wanted from the ground, the burning is deferred to the spring, and

they are gotten out by narrow roads, or from the sides during the winter.

Indian corn is the crop which follows the burning, being planted in holes made with a hoe, immediately after it, if done in the spring. Very little grass will appear, and two slight hoeings, keeping the stumps shrubbed will produce a better crop, than grubbing, coultering, and ploughing united, without burning. The second year the plough and coulter will bring up all the grubs killed by the fire, and a second cultivation, nearly or quite kills the few live stumps left. The value of the ashes as a dressing to the land, is evident from the crops.

Care should be taken, to give the fire a direction which will prevent it from doing mischief, as the more violent it is, the better. And if the ground cut down be inclosed during the winter with a wooden fence, a space of twelve feet wide should be cleared of combustibles adjoining it. The labourers should be numerous on the day of burning, and be armed with green pine or cedar boughs, if to be had, if not, with such as will retain leaves longest, to beat out the fire, if it trespasses.

If land be sufficiently covered with inferior growth, to insure a thorough burning, the business of clearing is expedited by belting the largest trees. This is sometimes the case in wet lands. These are drained, if necessary, by opening the water course, or by a small ditch, just sufficing in dry weather, to remove any obstacle to the burning from moisture. Then a sufficiency of the growth to produce a good cover and severe fire, is cut down, and the very large trees belted. The

land being opened to the view by the burning, the permanent ditches are more judiciously made. If it be full of roots, as will be the case where bushes abound, it is kept inclosed the following year and certainly throws up a great growth of weeds and small bushes. These when dry, furnish food for a second fire. And after a second burning, however matted with roots the land may be, it will if properly drained, produce a fine crop of corn. The roots, being dead, break easily to pieces; and the stumps and grubs are all killed, if the fires have been severe, and nearly so, if they have barely burnt over the ground. This mode of clearing is applied to boggy small streams, with great advantage, as it saves the expence of digging up masses of interwoven roots. I have made between 40 and 50 bushels of corn to the acre on such land, when the whole surface seemed to be a bed of dead roots, by a culture with the hoe, barely sufficing to keep under the weeds, and the few bushes which appear after burning.

Hitherto these observations relate to clearing new land. In the southern states it is often necessary to clear old, once exhausted, and grown up in pine and cedar. As it has not recovered its virgin fertility, but universally remains steril, there could be no advantage, in bringing it back to cultivation in this state, either rapidly or slowly. Without combining enrichment with clearing, a mean crop or two is all it can yield, and will not repay the expence of the latter, however reduced.

About twelve years ago, having a field which required enlargement, bordered by old, barren, broken, and gullied land, well covered with a growth of pine and cedar, except in the parts galled, which abounded; I cut down

about twelve acres, and covered one half with the bushes and rubbish of the whole, in stripes across the field of twenty yards wide, leaving intervals twenty yards wide also. These intervals I leisurely manured well by cow-pening. They were left to diminish the labour of removing the brush, and to diversify the experiment by extending it to every quality of the ground. The land remained covered and inclosed for four years, the stripes were burnt, and with the manured intervals being then put in culture, have since produced two very good crops of corn and two of wheat, lying in clover ungrazed, when not in cultivation. Last year, the clover would have made a saving crop of hay; this, the land goes again into corn. It has been difficult from the beginning to discover, whether the ground manured, or that left covered four years with the brush, was most enriched. The latter seemed at first to have the preference, but the stripes and intervals cannot now be distinguished. The whole is probably richer than in its virgin state, and its fertility is increasing, owing, probably, to inclosing, clover, and plaistering.

I have done something towards this experiment every year from its commencement. If there are no galled places or gullies, the stripes are burnt at the end of four years, if there are, the rubbish, too large to plough in, being collected by forks and rakes, is accumulated upon such places, which it enriches, by lying quiet four years more.

After the first four years, the annual repetition of the experiment, began annually to furnish some acres of land highly improved by brush. It has been suffered to remain five years, with increased benefit. A com-

plete exclusion of the hoof and the tooth, has attended the experiment from the beginning. This year, about five acres, the residue of the land necessary to enlarge my field, are cut down. Considerable portions are yet lying covered with the brush. Those in which the process is terminated, furnish of corn field, to be followed by wheat and clover, about fifty acres, twelve years ago worth nothing, and now though the most hilly, among the best I have.

From these clearings, stakes and brush for fencing in considerable portions, and all logs large enough for fuel, have been drawn during the process; and this necessity both protracted the experiment, and diminished its benefit, by diminishing the materials for covering the land.

Experience has convinced me that green bushes, with their leaves, enrich considerably beyond dry.

The success attending this mode of clearing exhausted land a second time, has induced me to apply all spare brush to the galled or weak spots of adjacent fields. A thin cover fertilizes them in four years to an equality with, or beyond the rest of the field. By an annual repetition of this practice, these humiliating evidences of bad culture, are rapidly obliterated.

By the mode of clearing new land, the labour of grubing, loping, heaping and burning brush, and of a hard and difficult cultivation the first year, is saved; the crop is better; and the several benefits of a rapid extension of tillable space, are obtained. By that of clearing worn out land, grown up in pine and cedar, one half is made to enrich the other, and the primary object in the countries where such lands are found, namely, an extension of fertile space, is thus promoted. The slow and gra-

dual mode of clearing is the cause, which reduces the fertility of new countries below that of the old; the first mode of clearing is leveled at it; the second is one among the numberless means by which new countries may repair the evil, if it should have taken place.*

April 10*th*, 1808.

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* In Mr. *Taylor's* letter inclosing the foregoing *memoir*, dated April 10th, 1808, he writes.—I have kept a flock of *from* 100 *to* 400 *sheep*, on the farm whereon I live, of our common breeds, with some care. The result is doubt, whether they suit our climate and soil. We are able on any rich land, to make 150 pounds of cotton to an acre. My calculation is, that this acre in cotton wool, produces 15 times more clothing, than it would do in sheep's wool. In a different climate the calculation would be different. However, from several considerations, I persevere in the experiment; having now, on the same place, 220 *sheep;* and should be glad to get a ram, and 3 or 4 ewes, of pure *Merinos*.

He is pursuing his extensive plan plan of *live fences;* and "*has planted several thousand young cedars, this spring*."

He writes to Dr. *Mease*, requesting to be informed of a good mode of preparing the *gypsum* for the mill; as "he intends gradually to encrease the use of it to 100 *tons annually*." Last year he sowed 200 acres with gypsum, one bushel to an acre, and planted corn, also rolled in gypsum, at the rate of one bushel, to one of seed corn.—The land was old, and had never produced 15 bushels to an acre within his memory. Thus treated, it produced above 25: but the year was uncommonly favourable.

He says, that his memoir on clearing land "contains actual experiments and results;" and professes to be "more of a practical, than a speculative farmer."

A few such spirited and "practical" farmers, would soon render the husbandry of this country, an object of emulation to any of the agriculturists, in either the old or the new world.

APPENDIX.

SELECTIONS.

On Smut in Wheat.

The opinion advanced by Mr. Somerville and others, of the animalcular nature of the disease called smut in wheat, is supported by Robert Harrup in Nicholson's Philosophical Journal, Vol. 13, p. 113. "The black dust, he remarks, consists of globules, which are heavier than water, with which they readily mix, but soon subside, suffering no change by being kept in that fluid. In the beginning of September, I infused some of the powder in water in a watch-glass. A few hours after, I discovered by the microscope, in a drop of the fluid, a few animalculæ. Upon examination, next day, every drop of the liquor contained innumerable animalculæ, generally very minute, but some a size larger. After standing exposed some days, the water evaporated, and an hour or two after the addition of fresh water, every part swarmed with animalculæ, moving nimbly in all

directions. While viewing them in the microscope, they suddenly became motionless, owing to the evaporation of the drop of liquid; on adding a drop of fresh water, they instantly revived, and began the same lively motion. A quantity of salt sufficient to saturate the water was then added to the mixture. Upon examination about twenty hours afterwards, I was much surprised to find the animalculæ as numerous and lively, as before the addition of the salt."

"The watch-glass with its contents, after standing neglected, on a shelf exposed to the effluvia of a variety of drugs, till the latter end of November, was again filled with water, and placed near a fire, placing at the same time by it a similar glass, containing smut-powder and fresh water. They were both frequently examined for some days, but without discovering any animalculæ. My attention being called off, they remained unnoticed about eight days. The glass which contained the infusion with simple water, was quite dry, and only a small quantity of fluid remained in the other. A drop being examined with the microscope by a single lens of high magnifying power, was found to swarm with animalculæ. Both glasses were now filled with fresh water, and placed under inverted jars. Being examined two days after, each of them swarmed with lively animalculæ. While viewing them, *a small particle of lime water was added to the drop*, which proved instantly fatal; at least, all motion ceased instantaneously, and was not renewed."

Mr. Harrup by a comparative experiment, shews the efficacy of steeping seed wheat in brine, and afterwards

liming it, in preventing smut, as recommended in a paper formerly read to the society.*

On Blight.

The following judicious remarks on blight in wheat by Mr. Marshall, deserve particular attention, on account of the mode recommended of checking the progress of the disease. An experiment of the practice he recommends, is certainly worthy of trial.

"That the operation of the disease is carried on by the fungus tribe, evidently appears from the labours of botanists.† But fungi it is equally evident, are an effect, not the cause of the disease. They are the vermin of the more perfect vegetables; and fasten on them, whether in a dead or in a diseased state, but seldom, I believe, while they are in full health and vigour. Their

* Mr. Wimpey in a paper published subsequent to that referred to page 55, adduces some facts to shew that this disease in grain, arises solely from the influence of the weather. To the objection to his theory arising from the remark, that in the case of two adjoining fields, one shall be free and the other infected, he replies, "that malignant currents of air, are frequently confined to a small space, and affect those objects only that stand in their way: that it is not uncommon to see trees and plants blighted on one side only: and that he has often seen the east and south sides of a field of wheat very smutty when the north and west, and the other parts of the field, have been little affected by it, and sound and smutty ears growing from the same root, and even sound and smutty grains at the same time, in the same ear. He says also, that clean grain will produce a smutty crop, and smutty grains yield a clean produce. This last fact, agrees with the experiment of Sir John Call mentioned page 56.

† See Sir Joseph Banks' paper on blight and rust.

minute and volatile seeds may be said to be every where present, ready to produce their kind, wherever they may find a genial matrix. Such at least appears to be the nature of the fungus, or fungi, of wheat; for it may be liable to the attack of more than one species. In a warm dry summer, which is well known to be favourable to the health, vigour, and productiveness of the wheat crop, the seeds of fungi are harmless, so long as the fine weather continue. On the contrary, in a cold wet season which gives languor and weakness to the wheat plants, few crops escape entirely their destructive effects. A standing crop not unfrequently escapes, while plots that are lodged in the same field, especially in pits and hollow places, become liable to their attack. Even strong healthy crops may in a few days or perhaps in a few hours, be rendered liable to be assailed, not progressively, as by infectious disease, but at once, as by a blast or blight. In the state of the atmosphere we are to look for the cause of the disease in a standing crop; and nothing is so likely to bring on the fatal predisposition of the plants, as a succession of cold rains while the grain is forming. The coldness necessarily gives a check to the rich saccharine juices which are then rising towards the ear, and the moisture may, at the same time, assist the seeds of the fungi to germinate and take root." In support of his opinion, Mr. Marshall adduces the following facts. "In 1804 (a very dry season) the disease was almost universal in England, except in two counties. The cause of the disease, in the county in which he had the best opportunity of observing it (Caermenthshire) appeared very

evidently, to proceed from cold rains which fell about the middle of August. Before that time wheat crops in general looked healthy, and were beginning to change to a bright colour. But presently, after a few cold wet days, the malady became obvious to the naked eye.* The straw lost its smooth varnished surface, being occupied by innumerable specks, which changed in a few days, in less than a week, to a dark or blackish colour, giving the straw a dusky appearance. Another instance of the blight of wheat succeeding rain, was observed in the same county in 1794. Another equally obvious, in 1785, in the midland counties, as may be seen in the "Rural Œconomy" of that department, minute 74."

As early ripe crops, are least subject to the disease, Mr. Marshall recommends early sowing as a preventive. "Corn, (grain) he remarks, which ripens under the hot summer sun in July, is not so liable to cold chilling rains, as that which remains unmatured until the sun begins to loose its power, and the nights to increase in length and coolness." The truth of this theory is confirmed by what has occurred in our own country. The farmers in the fertile, but moist peninsula between the rivers Delaware and Schuylkill, had suffered for many years so severely by mildew, from continuing to sow the old wheats which ripened late in July, or in August, that many of them ceased to cultivate wheat. At length the introduction of the "Isbell" or

[* In Pennsylvania, we observe that the disease almost constantly attacks grain, when frequent heavy fogs, or slight showers, are succeeded by dead calms and a hot sun, about the time of the grain filling.]

early wheat from Caroline county Virginia, which ripened the latter end of June or beginning of July, enabled them to resume the cultivation of that species of grain.

To prevent the extension of the evil in the crop, when once it has made its appearance, Mr. Marshall strongly urges the propriety of "cutting the grain so soon as we perceive it struck therewith; it may lie he says, on the stubble until the straw be firm and crisp enough to set up in sheaves, without adhering to the binding places; allowing it to remain in the field, until the grain shall have received the nutriment which the straw may be able to impart. Where wheat, he says, has been grown on lammas land, and the ground to be cleared by the first of August, he has known crops cut green as grass, and to be carried and spread upon grass land to dry. Yet the grain has been found to mature, and always to afford a fine skinned beautiful sample. Ray grass that is cut even while in blossom, is well known to mature its seeds with the sap that is lodged in the stems. Hence there is nothing to fear from cutting wheat or other corn, before the straw be ripe.*"

"It may be asked, in what manner the remedy is thus effected. But to the practical farmer the fact is all that is required. If it shall appear, that the fungus of wheat requires a free supply of air to keep it alive, or in a state of health and vigour, the effects of cutting down

[* In confirmation of Mr. Marshall's theory it may be mentioned, that the ears of indian corn, will harden and dry, although the stalks be cut off three weeks before they are ripe, provided they be set up in shocks in the field, or along the fences.]

the crop will be explained. It will perhaps be found by experience, that the closer it is allowed to lie upon the ground, and the sooner it is bound up in sheaves, (provided the natural ascent of the sap to the ear be not thereby interrupted,) the more effectual and complete will be the remedy. Further, it may be suggested, on the evidence of attentive observation, that if wheat which has been attacked by this disease be suffered to remain in the field with the ears exposed, until it may have received the ameliorating influence of dews or moderate rain, (to soften, relax, and assist the natural rise of the sap) the more productive it will become." See minutes of agriculture, in Surrey. No. 4.

"And it may be added, that grain which is cut while under ripe, is less liable to be injured in the field by moist weather, than that which has stood until it be fully over ripe.*

* Marshall's Rural Œconomy of west of England.

On the Flax Husbandry of Ireland, from the Farmer's Magazine, printed at Edinburgh. Vol. 7.—1806.

Sir,

Having for several years been engaged in the culture of flax, I devoted a part of last summer, to a tour through the manufacturing districts of Ireland. Here that branch of husbandry, has long been established over a large extent of the country, and conducted with considerable success.

During my progress through Ireland, the several processes of steeping, drying, and skutching were in hand, and I think I found a peculiarity of management in these, sufficient to affect the success of the whole business, and to confer a decided superiority on the produce of an acre of flax in Ireland over that in Scotland, both in quantity and value. It is no uncommon thing for a farmer, to sell a part of his lint on the foot, as it is termed, and for this he will commonly receive from thirty to forty guineas per acre.

1. *The method of steeping.* As soon as the crop has attained the proper degree of ripeness, the flax is pulled, and carried to a stagnant pool, dug for the purpose moderately deep. It is allowed to remain there only from five to seven days, according to the temperature of the weather. After the fermentation in the steeping process has been carried to a degree sufficient to produce the requisite laxity of fibre, the flax is taken out of the pool, and spread very thinly, on the stubble of the hay meadow. There, instead of remaining till it is merely dried, it is continued for three or four weeks,

till the grower conceives it ready for skutching. This bleaching process, has many advantages; the most obvious one is, that it enables the farmer, every time he examines it, to ascertain exactly, by rubbing on his hand, the precise point at which the fermentation has arrived, and thus to perceive the tenacity and strength of his flax; while the adhesion of the fibre has been sufficiently weakened, to admit of the skutcher cleansing it completely of the woody parts. It is, I am apprehensive, only the practical flax farmer who is able to judge of the importance, and delicacy of this part of the husbandry. It is so remarkable, that of two acres of flax, under precisely the same seed and culture, and of equal fertility, it frequently happens that the one shall yield a produce thrice the value of the other, merely from superior accuracy in ascertaining the proper line of continuing the steeping and bleaching processes.

2. *Smoking and drying.* The Irish seem to possess another advantage in their mode of drying their flax, before they submit it to the skutcher or beater. After the lint has remained a sufficient length of time on the bleaching green, it is gathered up into sheafs. and seems tolerably dry. In this state it is deemed by the Scots growers fully prepared for the flax mill; but far otherwise by the Irish farmer, who never submits it to the hands of the beaters, until it has undergone a thorough smoking over a peat fire. For this purpose, he raises at the back of a ditch, a small hurdle, thinly wrought with osiers, and places it on four posts of wood, at the height of four feet above the level of the ground. A pretty strong fire of peats being kindled below, the heat

and smoke pervades every part of the flax, which is placed perpendicularly above the hurdle. This process is continued, and fresh quantities of flax regularly added, till the whole crop is brought to a state of dryness, which in that moist climate, can never be effected by the sun and the weather: by this operation, a degree of brittleness and friability is produced on the straw, which greatly facilitates the ensuing work, and admits of an easy separation of the fibre from the wood. It is evident, that the less friction required in skutching, the less waste and diminution must be occasioned in cleaning the flax, and consequently, the greater must be the grower's produce from the mill. This part of the process is equally delicate with that described above, and requires, if possible, still greater attention on the part of the workmen, since it is clear, that by a careless management of the fire, the whole crop may be destroyed.

3. *Cleansing and dressing.* The flax husbandry of Ireland derives no small benefit from the application of hand labour in the beating and skutching of lint, thus superseding the use of the mill. The most careful and expert workmen are not always able to temper the velocity of machinery so exactly, as to preserve flax that has been over steeped or bleached to excess; while the steady and regulated impetus of the hand skutching, can be easily modified, as the circumstances of each case may require: a matter of obvious advantage, because the best flax mills seldom produce an equal quantity of lint, nor equally clean, with that which is obtained by the hand.

Change of seed not necessary to prevent degeneracy; naturalization of plants; important caution to secure permanent good quality of plants. By Joseph Cooper of Gloucester county, New Jersey.

[The following paper on several important agricultural subjects, has already been published in the *United States*, and in *Europe;* and has deservedly excited very general attention. The writer is entitled to every degree of respect, both for his practical knowledge, and integrity of relation. His experience and opinions differ widely from those generally received. The results produced, require the care and attention which few will give. The merit of Mr. Cooper is therefore the greater. That both sides of a question, in which agriculturists are highly interested, might fairly appear; the society have thought it right to add to their memoirs, this important developement of the practice and success of the writer. And this, not with a view to promote controversy, but to encourage and invite candid enquiry.]

Cooper's Point, April 17th, 1799.

Respected Friend,

Kind providence having placed me in a situation of life, which obliged me to procure a living by industry, and that principally in the agricultural line, it has caused me to be a strict observer of the works of nature, with respect to such parts of the vegetable creation as have come under my particular notice, and have been greatly embarrassed at the opinion very generally entertained by farmers and gardeners, that changing seeds, roots and plants, to distant places, or different soils or climates, is beneficial to agriculture, such opinion not agreeing with my observations or practice. This induced me to make many experiments on that head, all of which, in more than forty years practice, have operated to prove to my satisfaction, that the above opinion is not well founded, and if so, must be extremely prejudicial to agriculture, as it turns the attention of the husbandman from what appears to me one great object, viz. that of selecting seeds and roots for planting or sowing, from such vegetables as come to the greatest perfection, in the soil which he cultivates.

What induced me to make experiments on the subject, was, my observing that all kinds of vegetables were continually varying in their growth, quality, production, and time of maturity. This led me to believe that the great author of nature, has so constructed that wonderful machine, if I may be allowed the expression, as to incline every kind of soil and climate to naturalize all kinds of vegetables, that it will produce at any rate,

the better to suit them, if the agriculturists will do their part in selecting the most proper seed. In support of this position, I will subjoin a few facts and experiments, out of a great number, which have all combined to prove the above, to my satisfaction.

In or about the year 1746, my father procured the seeds of the long warty squash, which have been kept on the farm ever since, without changing, and are now far preferable to what they were at first. Our early peas were procured from London, the spring before Braddock's defeat (1756) and have been planted successively every season since, on the place. They have not been changed, and are now preferable to what they were when first obtained. The seed of our asparagus was procured from New York, in the year 1752, and since that time, I have not planted a seed, except what grew on my beds; and by selecting the seed, from the largest stalks, I have improved it greatly.

A complaint is very general, that potatoes of every kind degenerate, at which I am not surprised, when the most proper means to produce that effect is constantly practised; to wit, using or selling the best, and planting the refuse; by which means, almost the whole of those planted are the produce of plants the most degenerated. This consideration induced me to try an opposite method. Having often observed that some plants or vines produced potatoes larger, better shaped, and in greater abundance than others, without any apparent reason, except the operation of nature, it induced me to save a quantity from such only, for planting the ensuing season, and I was highly gratified in finding their production exceed that of others, of the same

kind, planted at the same time, and with every equal advantage, beyond my expectation, in size, shape, and quantity; by continuing the practice, I am satisfied that I have been fully compensated, for all the additional trouble.

A circumstance happened respecting potatoes, which may be worth relating: a woman whom I met in market, requested me to bring half a bushel of sweet potatoes for seed, the next market day, which I promised to do, but going through the market on that day, previous to her son's coming for the potatoes, I observed the woman selling such as I had brought for her; when the boy came, I asked him the reason they wanted potatoes for seed, while they were selling their own; his answer was, that his father said, if they did not get seed from me, once in three or four years, their potatoes would be good for nothing. Query, if he had used the same means in selecting his potatoes for planting, as I did, whether he would have profited by changing with one who used the other method?

In discoursing with a friend who lived at a great distance from me, on the above subject, he mentioned a fact in favour of changing seed. Some radish seed which he had from me, produced radishes preferable to any thing of the kind ever seen in that neighbourhood which was near 100 miles distant: but in two or three years, the radishes degenerated so as to be no better than what he had before; I asked his method of saving his seed; he said he had no other radishes in his garden, and when they had pulled what was fit for use, let the others go to seed. I then told him my method, viz.—As soon as the radishes are fit for use, I dig up

ten or twelve of those which please me best, as to colour, shape, &c. and plant them at least 100 yards from where any others bloom at the time they do; this, I informed him, was the best method I knew of to improve any kind of vegetables, varying the process agreeably to their nature; I asked him if he thought I should be benefited by exchanging with him? his answer was, he believed I was the best gardener.

In or about the year 1772, a friend sent me a few grains of a small kind of indian corn, the grains of which were not larger than goose shot, he informed me by a note that they were originally from Guinea, and produced from eight to ten ears on a stock. Those grains I planted, and found the production to answer the description, but the ears were small, and few of them ripened before frost. I saved some of the largest and earliest, and planted them between rows of the larger and earlier kinds of corn, which produced a mixture to advantage; then I saved seed from stalks that produced the greatest number of the largest ears, and first ripe, which I planted the ensuing season, and was not a little gratified to find its production preferable, both in quantity and quality, to that of any corn I had ever planted. This kind of corn I have continued to plant ever since, selecting that designed for seed, in the manner I would wish others to try, viz.—When the first ears are ripe enough for seed, gather a sufficient quantity for early corn, or for replanting, and at the time you wish your corn to ripen generally, gather a sufficient quantity for planting the next year, having particular care to take it from stalks that are large at bottom, of a regular taper, not over tall, the ears set low, and containing the great-

est number of good sizeable ears, of the best quality; let it dry speedily, and from this corn, plant your main crop, and if any hills should miss, replant from that first gathered, which will cause the crop to ripen more regularly than is common: this is a great benefit.

The above method I have practised many years, and am satisfied it has increased the quantity, and improved the quality of my crops, beyond the expectation of any person who had not tried the experiment. The distance of planting corn, and the number of grains in a hill, are matters many differ in; perhaps different soils may require a difference in both these respects; but in every kind of soil I have tried, I find planting the rows six feet asunder each way, as nearly at right angles as may be, and leaving not more than four stalks on a hill, produces the best crop. The common method of saving seed corn, by taking the ears from the crib or heap, is attended with two disadvantages, one is, the taking the largest ears, which have generally grown but one on a stalk. This lessens the production; the other is, taking ears that have ripened at different times, which causes the production to do the same.

A striking instance of plants being naturalized, happened by Colonel Matlack sending some water melon seed from Georgia, which, he informed me by letter, were of superior quality: knowing that seed from vegetables, which had grown in more Southern climates, required a longer summer than what grew here, I gave them the most favourable situation, and used glasses to bring them forward, yet very few ripened to perfection; but finding them to be as excellent in quality as described, I saved seed from those first ripe; and by

continuing that practice four or five years, they became as early water melons as I ever had.

Many admit the importance of a change of seed, from the fact of foreign flax seed producing the best flax in Ireland; but when it is considered that it is the bark of the stalk only that is used in Ireland, and that this is in the best perfection before the seed ripens, the argument fails when applied to other vegetables.

For many years past, I have renewed the whole seed of my winter grain, from a single plant which I have observed to be more productive, and of better quality than the rest; a practice, which I am satisfied, has been of great use; and I am fully of opinion, that all kinds of garden vegetables may be improved by the foregoing methods, particular care being taken, that different kinds of the same species of vegetables are not in bloom at the same time, near together, as by this bad practice, they mix and degenerate.*

* The above remark of an observant, practical agriculturist, has so often been confirmed by the observations of others, that no doubt can be entertained of its accuracy. The fact is one of the most powerful proofs of the sexual doctrine of plants, and is strongly confirmed by the familiar example of the certain degeneracy of squashes and pumpkins if grown near gourds; the latter even communicate an emetic quality to their neighbours. In like manner, melons will degenerate if planted near squashes or pumpkins. A case is recorded in the law reports, of an action which was brought against a gardener near London, in the reign of Charles 2, for selling cabbage seed instead of cauliflower seed. On trial it appeared, that both had been planted near each other, by the pur-

I am sensible the foregoing will meet with great opposition and contradiction, but as an experiment is safe and easy, I hope it will induce persons of more leisure, ability, and observation than myself, to make trial, as a mean of improving the agriculture of our country.

Such is the sincere wish of thy friend,

JOSEPH COOPER.

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chaser and to this error, the gardener contended the degeneracy of the true seed which he had sold, was owing. But he lost his cause in consequence of the prevailing ignorance of the sexual doctrine of plants: posterity however has rescued his memory from the imputation of a cheat. The fact quoted by Mr. William Young in page 53, may be adduced as another argument in favour of the propriety of attending to the caution of Mr. Cooper.

This fact, and the consequences of it, shew that lawyers should attend to agricultural and horticultural knowledge, as well as to mere professional acquirements. In an agricultural country, it is peculiarly incumbent on them: both for the purposes of justice, and personal advantage to themselves.

Account of the produce of various grains, planted September 18, 1787 *and* 1788.—*By the late Jacob Hiltzeimer, of Philadelphia.*

Cape wheat, 20 grains, produced 5050 grains.

White wheat, 13 grains, produced 6100 grains.

Winter barley, 19 grains, produced 17680 grains.

Summer barley, 48 grains, were planted on the 4th of April, 36 came up, and two of them produced smut; 34 yielded 20200 grains.

Rye, 13 grains produced 29200 grains.

All the grains were planted in rows 12 inches apart, and the grains 4 inches.

Produce of 1788.

Cape wheat, one grain produced 64 heads, which contained 2816 grains.

White wheat, 40 heads, containing 2240 grains.

Winter barley, 65 heads, 3900 grains.

Yellow bearded wheat, 58 heads, 3016 grains.

Speltz, two grains together, produced 104 heads, which contained 4368 grains.

The above grains were planted in the beginning of September, 1788, and the first four about six inches apart: the produce was presented to the society, July 14, 1789.

Produce of Mr. Stoneburner's land in 1787.

Twenty-one acres, produced 50 tons of hay.

Twenty-four acres, produced seven hundred and fifty dozen sheaves of winter grain.*

Twelve acres, produced at a moderate computation, four hundred bushels of oats.

Eight acres, produced one hundred and sixty-five bushels of buckwheat.

Four acres, produced one hundred bushels of Indian corn.

One acre and a quarter, produced four hundred and fifty bushels of potatoes.

Twenty head of cattle were fattened, and five milch cows pastured.

Germantown, March 4th, 1788.

[Those who are acquainted with Mr. Stoneburner, know the high character which he justly acquired and maintained as a farmer. It is to be regretted that measures were not taken to obtain from him, the particulars respecting the preparation of his lands for the above crops. Mr. S. himself, (a German by birth,)

* This would now be a crop entitled to no singular notice. The indian corn and potatoes are the best. The hay crop is good, but has been very often exceeded. Heavy, and over abundant grass, does not produce the best hay.

was more of a practical than literary cast. He could have dictated, though he could not write a detailed account; and he was moreover, not well acquainted with the English language. We are satisfied that the notes of our farmers could furnish many statements which would do equal credit to them, as the above does to the memory of an excellent citizen. They are therefore requested to favour the society with them. A powerful argument ought to stimulate them on the occasion, viz. the character of our country:—it is only by the publication of such accounts, that we shall undeceive the Europeans with respect to the state of our agriculture, which though giving much room for amendment, yet furnishes as great instances of produce as any country can boast of. The foregoing crops of 1787, are now frequently exceeded. A scale of progressive improvement could be formed, if additional facts, through the last twenty years, were furnished.]

On Hedges. By Thomas Main, of George Town, Potomac. Miscellaneous Remarks.

"Mankind are all disposed to take the shortest road that leads to the object of their desires, though it is frequently not the best; and it may be expected that many of those who have planted or intend to plant live hedges in this country, will be impatient to have them in perfection as soon as possible, or perhaps sooner than nature, assisted by all the efforts of art, has decreed that they should be so gratified. For the purpose of rendering half grown hedges fencible, many inge-

nious contrivances will, no doubt be invented hereafter. Such ideas as have come across my imagination to favour this end, shall now be freely communicated, leaving others to add thereto at their leisure."

Method of rendering a young Hedge impervious to black Cattle.

"Our cattle being accustomed to go at large, and used to pushing their way through brakes and thickets, we can only expect to debar them by live fences, through sheer strength of the plants which compose the hedge, and if they possibly can divide it with the help of their horns, some of them will undoubtedly, at times try to force themselves through, without much regarding the spines of the common haw-thorn, which would do little more to a strong steer than to tickle his tough hide, but in order to check his progress, and keep him on the outside, or keep him in if his owner should choose to have him there confined, it will not be difficult nor expensive to assist the young hedge in the following manner."

"When a hedge is four years old, let the top of it be trimmed at the proper season, to about three feet, or three feet and a half from the ground, a number of neat rails, or seasoned poles, sufficient to run the whole length of the hedge being provided, these are to be laid one after the other, singly along the top, exactly in the middle thereof, their ends being lapped past each other, and tied together with a piece of hickory bark, or some such cheap and ready ligature, the stubbs of the shoots will easily support them there until the new growth secure them in their place. The hedge

being annually trimmed as usual, in two years the rails will be found enclosed in the very center of it, so that any animal of a large size that may attempt to push its way through, will find it impracticable to divide the hedge."

Method for excluding Hogs.

"When the old protective fence seems to be on the decline, while the hedge has not yet attained sufficient strength or closeness to keep out pigs or hogs, that are permitted to go at large without yokes, the hedge may be strengthened to resist them by driving a short stake about two feet long in the vacancy betwixt each two of the plants; if these stakes are sufficiently durable to continue firm for two or three years, the hedge will probably at that period, be strong enough itself to keep hogs out."

"Another method to effect this purpose, may be commenced when the hedge has completed its second year, or when the stems of the plants nearest the ground, have attained the size of a person's thumb, then just before the bud begins to open in the spring, let the whole hedge be cut off by a saw, to within an inch and a half of the surface; the cultivation being continued as usual, the shoots that will arise from these stubbs will run up to four, five, or six feet the first season, and will be so numerous and full of thorns, that the hedge will in a few years be completely closed at the bottom; the trimming being annually attended to as before directed under that article. But it is to be observed that these strong shoots are at first easily disjointed from the stocks, and therefore cattle of every

description must be carefully kept from them until they are out of danger."

"A better way than either of these can be executed, when the field enclosed, is incommoded with stones."

"Having the hedge-course ploughed and harrowed level in the spring of the fourth or fifth year, the stones are to be gathered from the land, and the largest ones first laid along side of the hedge; having marked a space in width, proportioned to the quantity that can be had, or is capable of containing as many of them as are deemed sufficient; they are to be laid somewhat regular, so as to form a sort of loose pavement or diagonal wall with its upright face about fourteen inches high, bearing against the stems of the plants. The interstices among the large stones may be filled up with the smaller, so as to close every opening against the growth of weeds or other perennial plants."

"This will not only be an excellent barricade against swine, but will also tend to enrich the soil and promote the growth of the hedge; but it must not be attempted before the stems of the plants at the surface of the ground, have acquired the size of a stout walking cane, as the stones will harbour field mice, and other animals that would gnaw the roots of small plants, but will not trouble such as are of the size mentioned."

"Where stones cannot be obtained, another method may be taken to close the bottom of a hedge. After a course of flat rails, similar to those that are used in post and railing, are fixed along the inside, with their faces bearing against the hedge and raised a few inches from the surface—held in their places by small stakes or other simple contrivances—a mound of earth is to be

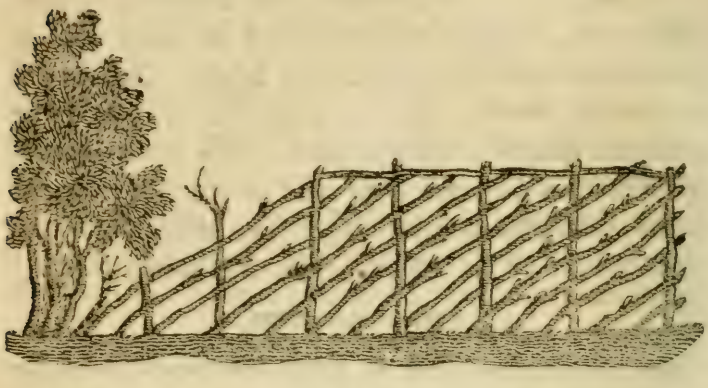
piled up in a sloping bank to support them—having first ploughed a narrow stripe at a little distance from the hedge-course, the more easily to procure mould for the purpose."

"This mound would rather be of benefit than detriment to the hedge, although if both its sides were to be banked up to any considerable height, it might kill it entirely; for there are few plants that can bear to be set much deeper in the ground than they grow naturally, but when the earth is elevated on one side only, the hedge will suffer no injury therefrom, and will thus appear planted on the side of a bank without any ditch."

Mode of Plashing Hedges. From Anderson's Rural Essays. See also American Edition of the Domestic Encyclopædia, Vol. III. page 277.

"When a hedge has been neglected, and gaps are formed, they must be filled by *plashing*. To do this, stems are selected, to be left at proper distances, the tops of which are all cut over at the height of four feet from the root. Straggling side branches of the other parts of the hedge are also lopped away. Several of the remaining plants are then cut over close by the ground, at convenient distances; and the remaining plants are cut perhaps half through, so as to permit them to be bent to one side. They are then bent down almost to a horizontal position, and interwoven with the upright stakes, so as to retain them in that position. The operator begins at one end of the field, and proceeds regularly forward, bending all the stems in one direction, so as that the points rise above the roots of

the others, till the whole wattling is completed to the same height as the uprights, after which it assumes the appearance somewhat resembling that which is represented in the following cut.



All the diagonal wattlings continue to live, and send out shoots from many parts of their stems; and as the upright shoots that rise from the stumps of those plants that have been cut over, quickly rush up through the whole hedge, these serve to unite the whole into one entire mass that forms a strong, and durable fence."

[*The following extracts from Lord Dundonald's "Treatise on the Connection of Agriculture with Chemistry" are published to shew the easy modes, by which every attentive farmer may gain important knowledge. They also impress the necessity there exists for those who have leisure and inclination, to study and promulgate at least so much chemical science, as can be usefully applied to the practice of agriculture.*]

Extracts from Lord Dundonald's "Treatise on the connection of Agriculture with Chemistry. Page 150."

The simple earths, air, water, saline bodies, vegetable substances, &c. &c. having thus been considered, as far as the properties of each relate to the present design, it is now become necessary, previously to any further discussion respecting the practical part, to give such directions to the cultivators of the soil, as may enable them to ascertain the nature and proportions which the component parts of it bear to each other; and consequently the value of the surface mould contained in the different parts of their farms or estates; and how, by this information, they may be enabled to apply with most advantage the several ameliorating substances herein recommended.

It has not been, nor would it be possible to avoid making use of chemical terms, consistently with the plan of a work, which has for its object the making every farmer, to a certain extent, a chemist, so that he may be enabled to understand the nature and properties of the several substances, in the management of which he is daily engaged; and that in all his future attempts to improve the soil, the success of his operations may no longer depend on guess-work, or on chance, but be regulated by a proper knowledge of the materials he may have to work with—how each may best be applied or acted upon, and what effects will ensue from their different combinations.

Cultivators of the soil should be able to distinguish, by chemical tests, the proportion of the following substances in different soils, viz.

Clay, chalk, sand, magnesia, earth of iron, and vegetable matter.

They should understand the properties and effects, and superior affinities of alkalis and acids; as well as the names, properties, and compounded electrive attractions attendant on the mixture of the different neutral salts, and their effects on vegetation. They should be well acquainted with the powers of lime, and should clearly and distinctly comprehend the putrefactive and oxygenating processes; as well as the consequences resulting from the action of fire on the vegetable matter contained in the soil.

The first step that a cultivator of the ground should take, when possessed of the above information, is to ascertain by experiments, in what proportions chalk, clay, sand, magnesia, and vegetable matter exist in the soil, in the different parts of the farm he purposes to cultivate; in order that he may, from such information, be enabled to administer to each part those particular substances that it may require, to constitute it rich and fertile mould. A soil of this description ought to contain a due proportion of the simple earths, and of the remains of vegetable and animal bodies.—To enable him to make the requisite experiments, he should procure the following articles and vessels:

Two sets of small scales and weights, one to weigh a few pounds at a time, and another smaller and more accurate, for ounces and grains: some porcelaine glass, or stone-ware vessels unglazed, such as are called

Vauxhall ware: some muriatic acid, and mineral alkaline salt. These being provided, the method of proceeding to ascertain the different proportions of the different substances in soils, is as follows:

The presence of calcareous matter is ascertained, by applying to the mould suspected to contain it, some marine acid diluted with water. If it contain calcareous matter, an effervescence will take place, and a neutral salt, called muriat of lime, will be formed. This is to be separated from the earthy insoluble matter, by a due proportion of water, and is to be evaporated to a certain degree. Lastly, the calcareous matter is to be precipitated by mild mineral alkaline salt. When the calcareous matter thus precipitated shall be collected, washed, dryed, and weighed, the quantity contained in the soil will be ascertained by the proportion it may bear to the weight of the *dry* mould on which the experiment had been made.

The same process and the same acid will serve to shew if magnesia be contained, and the proportion it may bear to the soil. Magnesia is not in general found in any very great proportion in surface mould, although there is more of it contained in ground than is generally imagined. It will for the most part, be found accompanied by calcareous matter; and as both these substances, when dissolved by the marine acid, are very soluble, and blended together, a separation is to be effected by the following process.

The earths of magnesia and calcareous matter are to be precipitated by mild mineral alkaline salt. The precipitate, or earthy residuum, when washed, is to be dissolved by a due proportion of the vitriolic acid diluted

with water. With the calcareous matter it will form gypsum, (a very insoluble salt) whilst with the magnesia it will form Epsom salt, a salt of great solubility. These salts are to be separated by priority of chrystallization, and their respective weights being ascertained, when deprived of the water of chrystallization, and brought to an equal degree of dryness, the quantity of calcareous matter and magnesia in each may be ascertained by BERGMAN's or KIRWAN's tables of the proportion of acid, alkali, earth, and water contained in different neutral salts. To those who are not provided with such tables, it may suffice to say, that

	Acid	*Cal. Matter*	*Water*
100 parts of gypsum contain	48	34	18
	Acid	*Magnesia*	*Water*
100 parts of Epsom salt contain	33	19	48

As both clay and sand, in different proportions constituting either a clayey or sandy soil, are distinguishable by the sight and touch, there is no occasion for giving any chemical test, to prove their presence. The proportion of the coarser parts of siliceous matter or sand, in soils or mould, may be ascertained by washing.

The presence of vegetable or carbonaceous matter in surface mould, when in any considerable proportion, is apparent, either from its black colour, or from the vegetable matter, appearing in the soil in an undecayed state. Chemical tests, in either of these cases, are unnecessary. When it may be requisite, however, to ascertain the presence or proportion of it in clayey or other soils, in which, from colour or extreme division of parts, it is less apparent, it is to be done in one or other of the following methods:

By properly drying and weighing a certain weight of mould, and then submitting it to such a degree of heat as will consume the vegetable or carbonaceous matter to ashes: at the same time, the heat must not be such as will disengage the fixable air from any calcareous matter or magnesia that may be contained in the mould or soil submitted to trial. The difference in weight between the dry mould, and that which is thus submitted to the action of fire, will be the proportion of vegetable or carbonaceous matter.

It is likewise to be done by melting some salt-petre in an iron ladle, bringing the salt-petre to a red fusion, and then dropping into it, by little and little at a time, the earthy matter, taking care previously to dry it thoroughly. The dropping in of the dried mould should be continued until the complete deflagration of the salt-petre is effected.

The practical observation to be deduced from the above experiment, is, that the soil or mould which contains the most vegetable or carbonaceous matter will deflagrate the greatest quantity of salt-petre; or, in other words, that it will require less mould to deflagrate a given weight of salt-petre, in proportion as that mould contains a greater proportion of imflammable matter.

The presence and proportion of vegetable and inflammable matters in clay may, in some degree, be proved and ascertained by the degree of blackness in the colour, which the interior parts of the clay assume, when subjected in the fire to a certain degree of heat.

The existence and proportion of most saline matters in soils are to be discovered by lixiviation, with warm water, and by subsequent chrystallization.

Gypsum is to be detected by boiling the earth with alkaline salts; in which case, the gypsum will be decomposed, and the vitriolic acid of the gypsum will join with the mineral alkali, forming Glauber salt, which is very soluble. The quantity of gypsum previously existing in the soil is to be ascertained by weighing, when properly dried, the calcareous matter which had been precipitated by the alkali; and by adding thereto, in calculation, the proportion of vitriolic acid necessary to constitute it gypsum; having previously deducted therefrom the proportion of fixable air which the precipitated chalk contains. The proportion of fixable air and vitriolic acid contained in chalk and in gypsum are in the proportions as here stated:

	Fixable Air	*Calcareous Matter*
In chalk,	43	53
	Vitriolic Acid	*Calcareous Matter*
In gypsum,	48	34

The following is given as an example of the method of making this calculation:

	Grains.
Residuum of precipitated chalk, - -	480
Proportion contained therein of fixable air,	212
Calcareous matter, - - - -	268
Proportion of vitriolic acid necessary to constitute gypsum with the calcareous matter,	354
Total quantity of gypsum, - - -	622

Utility of Pyrites as a Manure.

The following account of the utility of pyrites as a manure, by Mr. Livingston, is alluded to in page 158.

"In an excursion, I have lately made into Flanders, I observed, at some distance from the road, several large beds of earth, that appeared to me, to emit smoke and flame, which two men were tending. I stopped the post chaise, and went to examine it, I found that it was pyrites sufficiently impregnated with sulphur, to burn when dry. This was laid in beds and set on fire. They endeavoured to extinguish the fire, when the ashes became of a red colour. If it burned longer, it became black, and the quality of it not so good. This earth so burnt, was easily reduced to powder by wooden mallets, and in this state was carried upon the backs of asses forty or fifty miles as a manure, and was used particularly for grass, at the rate of about six bushels to the acre. The seed grain was also covered with it as with gypsum in our country."

[Pyrites consist of sulphur and iron, crystallized in various shapes, frequently in cubes: and abound in the United States, and especially in Pennsylvania.]

On the Fruit Curculio.

The following extracts are from the paper on the fruit curculio, by Dr. Tilton, referred to by that gentleman, page 189.

"The manner in which this insect injures and destroys our fruits, is, by its mode of propagation.—Early in the spring, about the time when the fruit trees are in blossom, the *curculiones* ascend in swarms from the earth, crawl up the trees, and as the several fruits advance, they puncture the rind or skin, with their pointed rostra, and deposit their embryos in the wounds thus inflicted. The maggot thus bedded in the fruit, preys upon its pulp and juices, until in most instances, the fruit perishes, falls to the ground and the insect escaping from so unsafe a residence, makes a sure retreat into the earth: where, like other beetles, it remains in the form of a grub or worm, during the winter, ready to be metamorphosed into a bug or beetle, as the spring advances. Thus every tree furnishes its own enemy; for although these bugs have manifestly the capacity of flying, they appear very reluctant in the use of their wings; and perhaps never employ them but when necessity compels them to migrate. It is a fact, that two trees of the same kind may stand in the nearest possible neighbourhood, not to touch each other, the one have its fruit destroyed by the curculio, and the other be uninjured, merely from contingent circumstances, which prevent the insects from crawling up the one, while they are uninterrupted from climbing the other."

"The curculio delights most in the smooth skinned stone fruits, such as nectarines, plumbs, apricots, &c. when they abound on a farm: they nevertheless attack the rough skinned peach, the apple, pear, and quince. The instinctive sagacity of these creatures directs them especially to the fruits most adapted to their purpose. The stone fruits more certainly perish by the wounds made by these insects, so as to fall in due time to the ground, and afford an opportunity to the young maggot to hide itself in the earth. Although multitudes of seed fruits fall, yet many recover from their wounds, which heal up with deeply indented scars.—This probably disconcerts the curculio, in its intended course to the earth. Be this as it may, certain it is, that pears are less liable to fall, and are less injured by this insect than apples. Nectarines, plumbs, &c. in most districts of our country, where the curculio has gained an establishment, are utterly destroyed, unless special means are employed for their preservation. Cherries escape better, on account of their rapid progress to maturity and their abundant crops: the curculio can only puncture a small part of them, during the short time they hang upon the tree. These destructive insects continue their depredations from the first of May until autumn. Our fruits collectively estimated must thereby be depreciated more than half their value."

"We are unacquainted with any tribe of insects able to destroy the curculio. All the domestic animals, however, if well directed, contribute to this purpose. Hogs in a special manner are qualified for the work of extermination. This voracious animal, if suffered to go at large in orchards, and among fruit trees, devours all the

fruit that falls, and among others the curculiones, in the maggot state, which may be contained in them. Being thus generally destroyed in the embryo state, there will be few or no bugs to ascend from the earth in the spring, to injure the fruit. Many experienced farmers have noted the advantage of hogs running in their orchards."

"Even horned cattle and all sorts of stock may be made to contribute to the preservation of our valuable fruits. By running among the trees, they not only trample to death multitudes of these insects; but by hardening the ground, as in lanes, it becomes very unfit to receive or admit such tender maggots as crawl from the fallen fruits. Besides, the curculio is very timid, and when frightened by the cattle rubbing against the tree or otherwise, their manner is to fold themselves up in a little ball and fall to the ground; where they may be trampled and devoured by the stock, poultry, &c. Col. T. Forest, of Germantown, having a fine plumb tree near his pump, tied a rope from the tree to his pump handle, so that the tree was gently agitated every time there was occasion to pump water. The consequence was, that the fruit on this tree was preserved in the greatest perfection."

"All the terebinthinate substances, with camphor and some others, are said to be very offensive to insects generally. Upon this principle, General T. Robinson, of Naaman's creek, suspends annually little bits of board, about the size of a case knife, dipped in tar, on each of his plumb trees. From three to five of these strips are deemed enough, according to the size of the tree. The General commences his operations about

the time or soon after the trees are in full bloom, and renews the application of the tar frequently, while the fruit hangs on the tree. To this expedient, he attributes his never failing success. Other gentlemen allege, that common turpentine would be still better; being equally pungent and more permanent in its effects. Some have sown offensive articles, such as buckwheat, celery, &c. at the root of the tree, and have thought that great advantages followed."

"*Ablaqueation*, or digging round the trees, and making bare their roots in winter, is an old expedient of gardeners for killing insects, and may answer well enough for a solitary tree, a year or two; but the curculio will soon recover from a disturbance of this sort, and stock the tree again."

"There is no surer protection against the curculio than a pavement. This, however, is only applicable to a few trees. It may serve in town; but will not answer in the country. [Flat stones may however be placed round the tree, and where lime is at hand, they may be cemented."]

"Many other expedients, such as smoking, brushing, watering, &c. may be successfully employed, for the protection of a favourite tree or two; but it is manifest, from the preceding history, that a right disposition of stock, especially hogs, among the fruit trees, can only be relied upon by a farmer, with orchards of considerable extent. And that the stock, poultry &c. may perform the task assigned them, it is evident, that a proper disposition of fruit trees is essentially necessary.

"As the smooth stone fruits are the grand nurseries of the curculio, special care should be taken, to have

these effectually protected. Unless this can be done, a farmer should not suffer them to grow on his plantation. He will derive no benefit from them; and they will furnish a destructive vermin that will ruin his other fruits. Cherry trees, nectarines, plumbs, apricots, &c. should therefore be planted in *lanes* and *hard beaten yards*, [or paved yards,] the common highways of all the stock of the farm, and not beyond the range of the ordinary domestic fowls. Orchards of apple trees, pear trees, peach trees, &c. should all be in one enclosure. The pear trees and peach trees may occupy corners of the whole design, so as occasionally to be fenced off. In large orchards, care should be taken that the stock of hogs is sufficient to eat up all the early fruit which fall, from May until August. This precaution will be more especially necessary in large peach orchards: for, otherwise, when the hogs become cloyed with the pulp of the peach, they will let it fall out of their mouths, and content themselves with the kernel, which they like better; and thus the curculio escaping from their jaws, may hide under ground, until next spring. Solitary trees of one fruit or another, remote from the orchard, should be regarded as nurseries of the curculio, and ought to be cut down or removed to the common enclosure. A young orchard should not be planted in the place of, or adjacent to an old one; that it may not be immediately infested with the curculio."

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Europe. And l observations.

as cultivated at S rom the city of
progress, than i

HAY RIPE.	RYE RIPE.	CH YEAR.
June.	9 July	ive.

A TABLE, BY PETER LEGAUX,

Of the progress of Vegetation in PENNSYLVANIA, *compared with that of some of the famous wine countries of Europe. And also exhibiting the results of various Meteorological observations.*

⁂ The variety of Grape-vine particularly noticed herein, is the *Munier*, commonly called Miller's Burgundy. It was cultivated at Spring-Mill, 11 3-4 miles in a direct line, N W by N from the city of Philadelphia, in an open country exposure, and, of course, later in every stage of its vegetative progress, than if growing in a sheltered and warmer situation.

LATITUDE, NORTH.	LONGITUDE.	PLACES.	YEARS.	GRAPE-VINES.										
Deg. M.	Deg. M.			WEEP OR BLEED.	IN LEAF.	IN FLOWER.	FRUIT FORMED.	FRUIT RIPE.	*Medium temperature of the whole year.* FAHRENHEIT. Deg. 1/10	HAY RIPE.	RYE RIPE.	WHEAT RIPE.	OATS RIPE.	TEMPERATURE OF EACH YEAR.
	From the Meridian of Philadelphia.		1787	*Planted the Vines.*										
			1788	15 *March.*	14 May.				53 6	12 June.	9 July.	13 July.	22 July.	Pretty dry and very vegetative.
			1789	18 do.	29 April.	19 June.	6 July.	3 Sept.	51 8	18 do.	9 do.	14 do.	24 do.	Moist, variable and cold.
			1790	15 do.	22 do.	14 do.	1 do.	25 Aug.	54 3	15 do.	6 do.	10 do.	20 do.	Variable and tolerably warm.
			1791	13 do.	21 do.	25 May.	18 do.	15 do.	53 8	14 do.	4 do.	11 do.	19 do.	Sweet, agreeable and moist.
			1792	7 do.	25 May.	17 June.	2 do.	2 Sept.	54 3	12 do.	2 do.	6 do.	14 do.	Warm and variable.
			1793	14 do.	28 April.	29 May.	19 June.	16 Aug.	54 5	6 do.	1 do.	6 do.	16 do.	Warm and moist.
			1794	18 do.	6 May.	26 do.	19 do.	20 do.	54 7	6 do.	31 June.	4 do.	12 do.	Very hot, dry and abundant.
			1795	20 do.	7 do.	12 June.	7 July.	10 Sept.	53 6	8 do.	1 July.	5 do.	14 do.	Variable, moist and warm.
			1796	28 do.	10 do.	24 do.	20 do.	14 do.	52 7	10 do.	4 do.	9 do.	18 do.	Moist and warm.
			1797	23 do.	1 do.	13 do.	5 do.	6 do.	51 3	15 do.	9 do.	14 do.	26 do.	Variable and cold.
			1798	20 do.	8 do.	2 do.	27 do.	1 do.	51 6	13 do.	8 do.	13 do.	22 do.	Variable, cold and moist.
			1799	30 do.	5 do.	16 do.	6 do.	3 do.	52 0	12 do.	7 do.	11 do.	18 do.	Moderate, variable and moist.
			1800	9 do.	29 April.	7 do.	30 June.	26 Aug.	52 2	10 do.	3 do.	6 do.	14 do.	Moderate, dry and abundant.
									52 5	9 do.	1 do.	4 do.	13 do.	Agreeably warm, moist, abundant.
40 4	0 8 W	Medium result at SPRING-MILL.		20 March.	2 May.	3 June.	4 July.	1 Sept.	53 1	12 June.	4 July.	9 July.	18 July.	Variable, moist, tolerably pleasant and vegetative. Prevalent wind, WNW.
48 60	77 33 E	At Champaigne, Lorrain, PARIS, and part of Burgundy.		20 March.	16 May.	16 June.	10 July.	1 Oct.	51 8	27 June.	27 July.	1 Aug.	6 Aug.	Cold & moist. Prevalent winds, NE & SW.
50 17	78 0 E	Arras,		Medium Temperature of the whole year, 48 4-10ths.										
50 51	79 33 E	Brussels.												
59 20	93 18 E	Stockholm.		Do. do. 42 8-10ths.										
16 6	13 27 E	Guadaloupe.		Extreme heat, 99 5-10ths. Extreme of cold, 65 7-10ths. Medium temperature of the whole year, 84 9-10ths.										
36 49	77 26 E	Algiers.		Medium temperature of the whole year, 65 7-10ths.										
11 12	155 6 E	Pondicherry.		Do. do. 78 1-10th.										

THE most intense cold which we have had in PENNSYLVANIA, between the first day of January 1787, and the first day of February 1801, according to a regular series of observations made at *Spring-Mill*, every day at sun-rise and at two o'clock in the afternoon, the thermometer in the open air, sufficiently shaded, about five feet from the surface of the ground, and out of the way of any extra reflection of the sun's rays, occasioned by walls, pavements, &c. happened on the 2d of February 1789, the mercury having fallen that day, to 17 5-10ths degrees below *zero* or 0 Fahrenheit; and the greatest heat during that period was in July 1793, when the mercury rose to 104 5-10ths degrees. July is generally, our hottest month, and our greatest degree of heat, *on an average of several years*, may be estimated at about 99 5-10ths. January is, usually, our coldest month, in the course of which, we may always expect a degree of cold, equal to 1 8-10ths below 0. All my observations, at the above place, from the beginning of the year 1787, to the end of the year 1800, have given as a medium for one year, 4 days of Aurora Borealis, 16 of thunder, 7 of tempestuous weather, 16 of snow, 249 of settled weather, and 73 of rain; and the *average* quantity of water which had fallen annually, to be 39 inches, 9 lines, and 11-10ths of a line, English measure. Our atmosphere is generally clear, and seldom so overcast, as to obstruct the rays of the sun, for four days successively.

The most intense cold which we experienced in the year 1804 was on the 25th of January, being 14 6-10ths below 0, the greatest heat, on the 4th of May and [illegible] of July, being on each of these days 95 degrees; and the medium temperature of the *whole* year, resulting from observations made on every day thereof, was 55 2-10ths.

In the year 1805, on the 14th and 15th of January, the mercury fell to 2 9-10ths below 0, on the 2d and 22d of August, it rose to 100 6-10ths, and the medium temperature of the whole year, was 57 9-10ths. It is observable that the medium heat of each of these two years, was much greater than of any year from 1787 to 1800 inclusive.

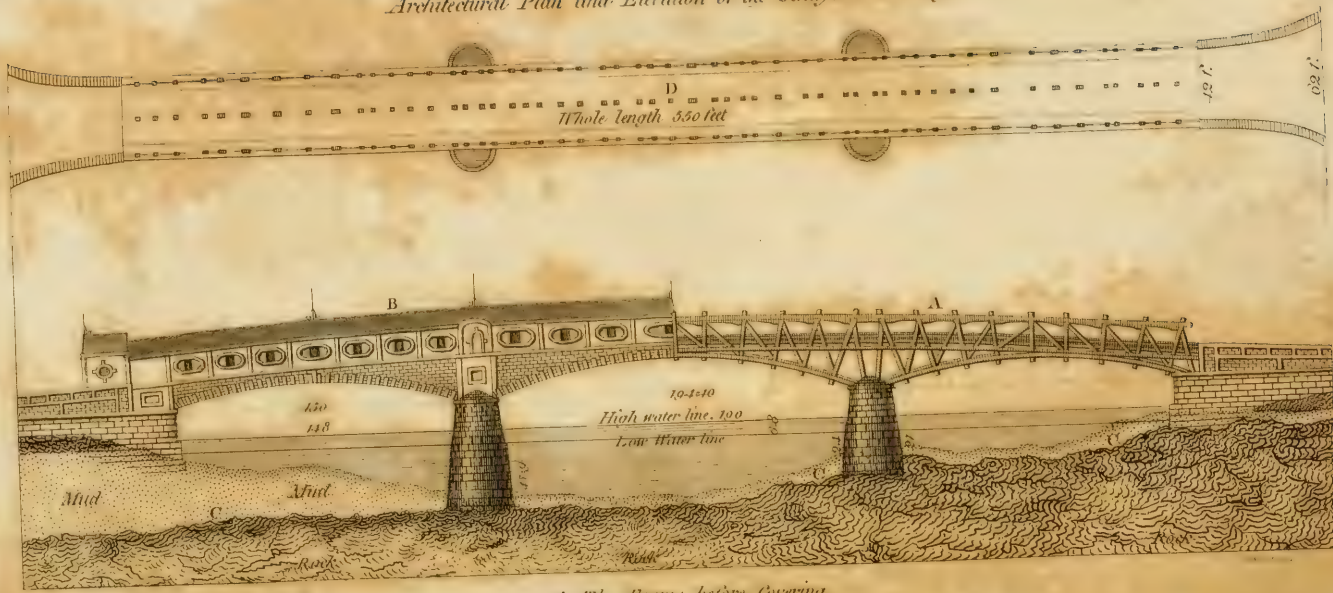
In Paris, the greatest summer heat is, *commonly*, between 92 7-10ths and 95 degrees, the most intense cold, between 9 5-10ths and [illegible], and the medium heat of the whole year, as established on the result of 70 years observations, 51 8-10ths. But in the year 1716 the mercury had fallen there, to 3 4-10ths below 0, in the year 1720, it rose to 104, and in 1753, to 99 5-10ths. The coldest month at that place is January, and the hottest August.

At Hoorn, in Holland, in the year 1763, the mercury had fallen to 8 degrees, which is marked on some of the Dutch thermometers, as a remarkable degree of cold.

Ice or snow mixed with kitchen salt, produces a degree of cold equal to *zero* or 0 of Fahrenheit. The point at which still water *begins* to freeze is 32, and is consequently, called the freezing point. Rivers or running waters, freeze at 20 7-10ths, cider and vinegar at 11 7-10ths, and unadulterated wine at 5 degrees. The medium temperature marked on Botanical thermometers, as best adapted for the Pine Apple, is 73 6-10ths; for Melon-beds 69 1-10th, and for an Orangery 57 9-10ths.

The constant temperature of the cellar of the Observatory at Paris, is 53 5-10ths, which is generally considered to be the same, in every part of the globe, at the depth of about 100 feet beneath the surface. The most salutary temperature of the sick or patient's room, is thought to be 72 2-10ths. The heat of the human blood, in the opinion of the Faculty of Medicine at Paris, is 97 5-10ths; on the English thermometer, it is marked 98, on several thermometers made in Holland and other places of the north of Europe, 97. Heat of Hen's incubation 103 2-10ths. Fever heat 112. Rain or distilled water boils at 212 degrees, when the mercury in the barometer stands at 30 inches. [In every year, even in the same neighbourhood, a week's difference may be observed in the grain harvests, owing to early or late sowing, qualities of the soil, exposure, and nature of the grain.]

Architectural Plan and Elevation of the Schuylkill P. Bridge.



A *The Frame before Covering.*

B *The Cover.*

C *Surface of the Rock at the Bottom.*

D *Platform.*

A

STATISTICAL ACCOUNT

OF THE

SCHUYLKILL PERMANENT BRIDGE,

COMMUNICATED

TO THE

PHILADELPHIA SOCIETY

OF

AGRICULTURE,

1806.

PHILADELPHIA:
PRINTED BY JANE AITKEN, NO. 62,
NORTH THIRD STREET.

1807.

THE following account of SCHUYLKILL PERMANENT BRIDGE, *and the circumstances connected with it, was drawn up, at the request of one of the proprietors of an extensively useful publication, now in progress. It was found, that the plan of the work did not admit of its being inserted under any one article; and it was therefore withdrawn. In conformity with the design of our institution, it has been presented to the Society. A statistical view of an erection so important to agriculture and the arts, is deemed worthy of being communicated among the objects of our attention. The interests of this great commercial city, and the accommodation of all the inhabitants of this and other States, whose affairs require an intercourse with it, through this approach, are promoted by an enterprize completed with private funds, and by the exertions of a few persevering individuals. Though the facts of its history are local, many of them furnish instructive lessons of general importance.*

Philadelphia, 1806.

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A STATISTICAL ACCOUNT

OF THE

SCHUYLKILL PERMANENT BRIDGE.

THE State of *Pennsylvania* has long been deservedly famed, for the multitude and excellence of its bridges, over the various smaller streams, by which it is intersected. But no permanent means of transportation across the large and widely extensive rivers, flowing in and through, or bounding, this fertile and flourishing region, had, until a late period, been attempted. That thrown lately over the *Schuylkill*, at the west end of the *High* or *Market Street* of the city of *Philadelphia;* one over the same river at *Reading;* those over the *Lehigh* at *Bethlehem*, *Weiss's* ferry, and one near its discharge into the *Delaware;* have begun the career of hydraulic architecture, which will increase the celebrity of this State in that important branch of public improvement. A bridge over the *Delaware* at *Easton*, connecting *Pennsylvania* with the State of *New Jersey*, is in great forwardness;* under the direction of Mr. *T. Palmer*. One on a peculiar construction, and highly necessary for the passage of the mails, and other constant transportation, upon the great Post road of com-

* Since the account was drawn up, it is completed in its Frame, which, after the example of the Schuylkill bridge, is covered.

munication, between the cities of *Philadelphia* and *New York*, is recently finished. It is situated at *Morrisville*, and near *Trenton* on the *Delaware;* and also connects the State of *Pennsylvania* and *New Jersey*. This latter has been erected at the expence of a Company, under the superintendance of Mr. *Theodore Burr*, who, as well as Mr. *Palmer* is a self taught and ingenious *American* Bridge Builder, and has evidenced much talent as well as industry in this structure.

The success of the *Schuylkill* bridge, as far as it had proceeded, was exemplary; and instigated the commencement of this work, as well as encouragement in its prosecution. All these erections are highly honorable to those who promoted, supported, and completed them. But that over the *Schuylkill*, is the only successful undertaking of the kind, attempted and carried to perfection in and over a deep *tide water*. It has been attended with the most difficulty and expence; and has, in consequence, more particularly called forth the talents, exertions, and perseverance of those engaged in it.

The *Schuylkill*, which washes the western front of the city of *Philadelphia*, although it affords great advantages, had long been attended with many serious inconveniencies. The frequent interruption of passage by ice and floods; and the inefficient and uncertain mode of crossing heretofore practised, had, for a long course of years, employed the thoughts and attention, of many ingenious, and public spirited members of the community. The character of this river is wild, and, in times of floods, rapid and formidable; and, to any structure of slight materials, ruinous and irresistable.

Its borders, to an extent of one hundred miles, are skirted by precipitous mountains and hills. Its tributary streams, suddenly filled, in seasons of rains, or melting snows, with the torrents rushing down their sides, without notice or time for precaution, fill the river with frequent floods, which no common works of art within their reach, have heretofore been capable of withstanding. Although these attributes, are not to a certain degree uncommon, yet, in this river they are peculiarly dangerous. They occur at irregular periods, and often at seasons of the year, when floods are generally unexpected. These circumstances, at all times created doubts of the practicability of any permanent erection. The depth of the water opposite to the city, added to the difficulties and apprehensions. The expence in the early periods of its establishment, precluded any plan, requiring large expenditures by those who then inhabited Philadelphia and its vicinity. In the year 1723, March 30th, a law was enacted "by the Governor "Sir *William Keith*, "by and with the consent "of the Freemen of the province, in General Assembly "met," (which shews the then style of the laws,) entitled, "An act for establishing a ferry over the river "*Schuylkill*, at the end of the *High Street* of *Philadel-* "*phia*," granting to the then Mayor and commonalty, the right to make and maintain causeways, on both sides of the river, and to erect a ferry at the west end of *High Street*. Certain tolls were then fixed; which the present rates do not, in any case far exceed, and in many instances, i. e. for country produce and manure, are much, and liberally reduced. No person or persons (without violating that law) could then, or can now,

"keep or use any boat or canoe, for transporting any "person or persons, creatures or carriages, for hire or "pay, over the said river, in any other place between "these ferries, now called *Roach's* (late *Ashton's* now *Sherridine's*) "and *Blunston's*" (late *Gray's*) "Ferries "on the said river, besides the Ferry thereby establish-"ed." By virtue of this law, the corporation of the city, have held and exercised this exclusive Franchise, from the time of its being so granted, until their transfer thereof to the present Permanent Bridge Company. The Ferry was maintained, and generally used, until the floating bridges were thrown over. In times of interruption of the passage of those bridges, by ice and floods, (which too frequently occurred) the boat was resorted to, for temporary transportation, and always kept in readiness for use.

In December 1776, when the *British* troops had overran, and nearly subjugated the State of *New Jersey*, *General Washington*, apprehensive of being forced to retreat, with the shattered remnants of his patriotic, but enfeebled army, wrote to *General Putnam*, then commanding in *Philadelphia*, directing him to take measures for the speedy passage of the *Schuylkill*, in case of urgent necessity. Orders were at the same time given to collect all the boats attainable at *Wright's*, and other ferries on the *Susquehanna*. No pontoons existed, with which to comply with the orders of the commander in chief. It fell to the lot of the individual, who originated the project of the present Permanent Bridge, and who then held a confidential office under the *United States*, to be consulted on the subject. Having advised with some Ship-Wrights, a bridge of

boats was at first thought of; but finally one of ship carpenter's floating stages, used for graving ships, was concluded upon. This plan, on being suggested by him to *General Putnam*, was instantly adopted and promptly executed. The critical and masterly stroke, made on the *British* auxiliaries at *Trenton*, superseded its military use at that period. It gave, however, the first idea of the floating bridges, over the *Schuylkill*, composed of buoyant logs, for the support of a platform of planks; two whereof now remain, at *Gray's* and *Sherridine's* ferries. There does not appear to be any express authority by law for the establishment of these bridges. The act of 1723 recognizes the two ferries of *Roach* and *Blunston*. An act passed since the revolution, regulates and directs the lowering the *ropes* of ferries, and opening the bridges (which had each *Slip pieces* for this purpose) within a certain time, on notice, under a penalty. This implied permission, appears to be the only warrant for their continuance. The first of the log bridges was erected by the Executive of the state. This was either much injured or destroyed.

A bridge was constructed by the *British* army in 1777, when in possession of the City, on pontoons or large boats. But this not sufficiently answering their purposes, another was thrown over, composed of planks supported by floating logs after the pattern, and perhaps with part of the materials of the one which had succeeded the bridge of Stages, and is probably the one now at *Gray's* ferry. One of the pontoons, used by the *British*, prolonged the hostility which occasioned its fabrication. Two of the piles of the *coffer dam*, sunk for the erection of the western pier of the present per-

manent bridge, were obstructed by a part of one of those boats which had been accidentally sunk in 1777, 28 feet below common low water. It occupied part of the area of the dam, with one end projecting under two of the piles of the inner row; and had nearly rendered the erection abortive. It was first discovered on pumping out the dam ,in 1802; and was perfectly sound, after a lapse of 25 years. The iron work had not the least appearance of rust, or the wood (which was common oak) of decay. The taking this boat to pieces, the straining the dam, and the leaks in consequence, were the chief causes of an extra expenditure, by the company of more than $ 4000, hardly and perilously disbursed in pumping (which alone cost from $ 5 to 700 per week) and other labour, during forty one days and nights, in the midst of a most inclement winter!

The privations of supplies from the country on the western side of the *Schuylkill*, had always been causes of regret, and too often of increased expence, to the inhabitants of the City. These were most severely felt, as the population increased. It would be perhaps irksome, to attend to a recital minutely, of all the schemes suggested, for a permanent passage, through a period of near seventy years. It will be sufficient, shortly to mention some of them. To those who have been actively concerned in the present structure, most of these projects appear to have been impracticable, or unadvisable. If they could have been executed; the funds were unattainable.

Some would have the river filled with a dam and causeway; after a bridge had been built on the flats of the fast land, and a channel cut through these flats.

Some proposed a low stone bridge; to be used only when the river was in its ordinary state; and when raised by floods, the torrent should run over the bridge. Thus intermitting its use, when it was most required. Some would have, with any bridge, arches, turned from hill to hill, and thus occupy with impediments, the low grounds, which now afford additional passage to the overflow of the stream. The expence too, would require the funds of a state; and never could have been accomplished by private advances, with any prospect of profit. Any buildings, or other obstructions, placed on these flats, will confine, and, of course, redouble, the force of the current. They would cause the accumulation of the ice, and damming of the stream; the most formidable foes the bridge has to contend with. Some had proposed a bridge on chains, stretched across the river, and elevated by columns, of vast height, on its banks. Adding to this visionary plan, some of its advocates would have pillars, in the middle of the river, on a kind of wharf, containing stone promiscuously thrown in. On such an uncertain, shifting, and unstable foundation, more modern projectors have contemplated erecting wooden superstructures; and are not yet persuaded of their being dangerous and insecure. If such should succeed in a river of tranquil current, and level bottom, they are not calculated for one frequently impetuous in the extreme; in some parts of its bed, covered with mud, in others uncommonly unequal and rocky. Still more ineligible, in one, irregular in its depths; which suddenly vary, at small distances, so as to afford no encouragement to depend on any foundations, or supports for a bridge, but those of solid masonry; and this founded on the rock, which stretches across its bottom,

Without entering into controversy on the merits or defects of these plans, which were proposed for the position of the present bridge, they are barely enumerated, with some of the objections to their establishment.

Before the Revolution, at various periods, citizens of intelligence and talents, had abandoned the idea of erecting a bridge, in the deep tide water, opposite the city. They sought for situations, less difficult; and higher up the river. Applications were presented to the General Assembly of the Province; and surveys and accurate examinations were made, under the directions of a committee of the Legislature. The places viewed, were *Peters's Island*, and the *Fording place*, nearer the falls; which was, in early times, the most common passage over the river. The road leading over it, is called, in antient deeds and other writings, "*The old Lancaster road.*" A third site offered for the consideration of this committee, was the *great falls of Schuylkill;* where such an erection was said to be practicable, directly across the reef of elevated rocks, forming the obstructions in that part of the stream. Maps and measurements of these places, and their distances from the city, and particularly of *Peters's Island*, (which was the place generally fixed on, as possessing the greatest facilities and advantages, positive and relative,) were made, and are yet extant. The route to *Lancaster* by this place, through part of the *Ridge* or *Wissahiccon* road, is shorter than that passing over the bridge opposite the city. The distance by either place is not much greater. Although a bridge may be erected, at either place, for a sum not exceeding a fourth, and probably a fifth, of the cost of the permanent bridge at *High street*, yet these

sites cannot rival the latter. They do not unite all interests, by being so generally accommodatory to travellers and transportation, from all quarters, southerly and westerly of the city. Their use will therefore be partial, and the object of a distant day. *Conflicting interests*, and the disinclination of the Legislature, to afford sufficient means out of the public funds, occasioned the abandonment of the measure at that time. The competitions ended in a lesson, which zealous schemers never read; to wit;—Opposing advocates, for local and clashing advantages, not unfrequently gain nothing; and are sure to defeat the object of all.

Another project of a bridge over one of these places was proposed, at the time when the canal from *Norristown* was first contemplated. The canal was thought, by many persons of intelligence, to be more easily and œconomically practicable, on the west side of the river. It was proposed to erect, at one or the other of the places last mentioned, an *aqueduct bridge*, over which, the canal should cross the river; with a tow-path or passage way, on each side of the channel for the water, for travelling and land transportation. This is yet believed to have been not only practicable, but also, that it could have been nearly completed, with the sum expended on that unfortunate, though highly desirable enterprize. This is not mentioned with any view of censure; because the obstacles occurring on the east side, very many whereof would have been avoided on the west, compelled expenditures, not calculated upon or foreseen: And pre-conceived opinions are often found fallacious, when brought to the test of practice.

A little out of its order, is mentioned the last unexecuted plan, for erecting a wooden bridge, over the middle ferry, in the year 1767. A subscription for the purpose was circulated, and many respectable citizens agreed to contribute. But this, from various causes, fell through; and all efforts to accomplish the object were suspended for many years. This bridge was contemplated to be of one arch, with stone abutments; a plan still believed by some of its former advocates, to be practicable and most œconomical. The intended span was to have been 400 feet: height from the water 47 1-2 feet.

In theory, it seems reconcilable with principles, that an arch of wood or iron, may be extended to any length of span, with sufficient elevation. The point of either practicability or discretion, has never been precisely fixed. In a modern proposal for a single arch of iron, over the *Thames*, in place of old *London Bridge*, a project is exhibited for an arch of 600 feet span. All agree in the theory, but practical men shrink at the danger; though there are respectable opinions of intelligent theorists, in favour of its principles. According to the best opinions of practical men here, (among them Mr. *Weston* and Mr. *Palmer*,) one of 200 feet begins to be critical and hazardous. The timber arch of *Piscataway* bridge, erected by Mr. *Palmer*, spans 244 feet, but he declared he would not again attempt one of similar extent. The most intelligent among those who have gained experience in the late structure, believe, that the span intended for the *Schuylkill*, in the last project, the draft whereof has been often seen by them, was too extended *for this spot;* and that it would most probably have fail-

ed. The weight of transportation here is uncommon and constant, and the friction of course incessant. Strength, symmetry and firmness, are required here; of which one very extended arch is incapable. Although wood or iron may be so framed, as to have the least possible *drift*, or *lateral thrust*, on the abutments or piers, yet there is a point, beyond which it is dangerous to pass. Of stone or brick it would be adventurous, beyond all common discretion, to risque an arch of such a span. Nor is the undulatory motion of an extensive arch, (however composed) an unimportant objection.

A bridge of so extended a span must have been (to be safe) so much more elevated, that the filling would have pressed the walls too dangerously. Some relief might have been given by culverts, or reversed arches, to save filling; but these are not without their disadvantages. The pressure on the walls of the present western abutment and wings, is quite as much as masonry on piles will bear; and no other foundation could have been had, but at an unwarrantable expence, the rock at the site of the abutment, being covered with mud and gravel 38 to 40 feet deep. It was deemed, and found prudent, to sink the whole frame of the present structure, three feet into the piers, and imposts of the abutments, as well to avoid over weight of filling, as to depress the platform, or travelling floor, to a point easy of access. An approach of the abutments, for an arch of 400 feet span, would have created a necessity (not known when such a plan was proposed) for *coffer dams*, and all their dangers and expence. The present bridge enlarges the passage for the water, at least, a fifth. One for an arch of 300 to 350 feet, would have diminished it in a greater

proportion; because the abutments must have approached each other, so as to occupy the position now open, through the land or side arches.

No persons engaged in such difficult works, should risque any project to save expence of foundations, for piers or abutments. But on the other hand, *coffer dams* should be avoided, if any other means can, with common prudence, be adopted. Their expence is enormous, and their success not always to be ensured. The great proportion of the expenditures in the *Schuylkill* bridge, has been incurred by the inevitable necessity for *coffer dams*. The labour applied, and the difficulties encountered and overcome, will appear to the best informed engineers, uncommon and singularly arduous, as will appear by the short account of them subjoined to the present statement. Every effort was made to avoid the necessity of these dams, but on duly weighing all the projects suggested, none could be adopted with any prospect of safety. The irregularity of the bottom, and depth of water, at once were found to forbid the use of *Batterdeaus*. *Floats* were thought of, composed of a platform of logs, on which masonry should be formed. These were to be built on, with logs at the sides, and others crossing the whole, bolted like wharves; filled in with masonry, and raised on as they sunk, till having lodged on the bottom, they should compose the foundation for masonry, from low water mark. But no horizontal, or solid position could be obtained for them. All the objections to *batterdeaus* lay against them. A flood too, might have carried them off in an unfinished state. This was proved, when a few of the belts of the *coffer dam* (light and buoyant,

compared to these floats, and more easily secured) were swept away by a summer fresh; though they had been supported by some piles, and moored with anchors and cables, capable of holding a stout frigate. The levelling the bottom, or making one artificially (as was done by *Semple* at the *Essex* bridge in *Dublin*) was found impracticable, on account of the thick cover (13 feet) of mud in some parts, and the total bareness and unevenness of the rock in others. It became a choice of difficulties; and the *coffer dam*, or no bridge, was the alternative. Projects easily and cheaply to be accomplished in shallow streams, with level bottoms, or those capable of being artificially made so, were all found impracticable, and to the last degree imprudent here. The modes pursued in *New England*, either of piles, wharves, log frames, or stones loosely thrown into the stream, were considered and condemned. The destruction of many of the bridges of that country was predicted; but with a hope that this apprehension might prove unfounded, as the enterprizes of the people there were admired and applauded. *Sounds*, or arms of the sea, sheltered from violent storms, broad rivers, capable of holding piles, and affording extensive flats, for overflows and waste of floods; will admit of slighter foundations, though always exposed to danger, under uncommon circumstances. Many of the sites of eastern bridges are of this description.

The pressing necessity for some permanent structure, called the attention of many citizens to the subject. But none, for a long course of time, attempted any decided measure, till the one whose endeavours where finally crowned with success, in the accomplishment of the

present erection, moved in this important *desideratum*. It was contemplated, originally, to erect the bridge, at a small distance above the upper, or *Roach's* ferry. One object in fixing on this site, was its supposed advantages in point of practicability. But no inconsiderable motive, was that of leaving the whole western front of the City unobstructed by so great an impediment to the navigation of the *Schuylkill*, which has already shewn itself to be of inestimable consequence. The improvement of this western front, depending so much on the navigation of the river, is already in great progress. It will add to the evidence of foresight and sound calculation, possessed by its great founder *William Penn*, when he decided on the plan of our justly celebrated City. At length however it was seen that a project of a bridge, to be effectuated by private advances, could only be accomplished in a spot, in which a majority of interests and opinions where united. Endeavours, which, through many difficulties succeeded, were therefore commenced, for obtaining from the City corporation, the site of the present bridge; and forty thousand dollars (one half in bridge Stock) were paid, as the consideration. The General Assembly had, by a law, granted to the Bridge Company, the right of the Commonwealth to a valuable lot adjoining this site, on the eastern, and a purchase had been made of property on the western side of the river, which is now highly accommodatory. It is unpleasant to mix the alloy of regret, with the purity of approbation which must attach both to the site, and the structure there established; yet it is to be lamented that one half of the western front of the City, is deprived of navigation on a great scale. E'er long this river will

pour into the lap of commerce, abundant supplies for foreign markets; and the land transportation passing over it, is very considerable. Twelve feet water can be carried over the bar at the river's mouth; and it is well known, that a channel may be made, to escape the bar, for large vessels, at no formidable expence. Four fathoms, on an average, may be carried, after passing the bar, up to and along the whole City front. It is to be most seriously hoped, that no obstacles to this important navigation, will in future be added. One error probably unavoidable, which cannot now be rectified, committed in the zeal for a new and essential improvement and accommodation is enough. Passages for vessels, through *draws*, should be insisted on, if at any time other bridges should be required, where they interfere with the navigation. Posterity should never be disinherited, to serve present and partial objects.

The impediment to the navigation of the *Thames*, by old *London* bridge, has long been highly injurious. Insomuch that it is said, in an estimate presented to the *British Parliament* a few years ago, (1801) that the difference in the price of *coals above*, from that *below* bridge would in a short time, pay for taking down the *old*, and building a *new bridge*, to admit large vessels, either *under*, or *through* the bridge, by means of a draw. And there is a great plan in progress for that purpose.

It is mentioned with no view to personal adulation, but as a successful instance, for the encouragement of persistance in commendable pursuits, too often thwarted by opposite interests or opinions, that the " *Act for incorporating a Company for erecting a Permanent Bridge over the River Schuylkill, at or near the City of Philadel-*

phia " was obtained, after persevering efforts, during several years by the exertions of *Richard Peters*, who was elected President of the Company, formed in virtue of that Act. He originated the project of the present structure, and assiduously assisted in its execution, from its commencement to its completion. In a pursuit, generally deemed hopeless, though so obviously of public utility, he was left solely, to encounter, in its early stages, strong prejudices and incredulity as to its practicability, and many local interests and objections, both as to the place and principles of its establishment. Much opposition from several respectable quarters, was to be overcome, before this law could be obtained. This was the more difficult to combat, because it was grounded on laudable principles; though it was foreseen, as the event proved, that their objects were unattainable; and therefore that no bridge would be erected, but one according to the project effectuated by the present company. Twenty one townships, on the western side of the river, represented by respectable citizens, combined to prevent the scheme for a toll bridge; under the idea that they could obtain one free of toll, and built by subscription, aided by public support. But as this mode of raising funds, could not be accomplished, the attempt, (the success whereof was very much to be wished) was abandoned. The Corporation of the City, were very commendably anxious to erect a bridge on their property, under the direction of the City Councils. This would have been an appropriate and desirable object. But funds could not be procured; and their opposition was withdrawn. The expensive and most extensively useful *Water Works*, had involved the City corporation in pecuniary

difficulties; and operated, in no small degree, to induce a sale, of their ferry franchise, to the company incorporated for erecting the bridge.

The Act before mentioned was passed the 16th of March 1798. Its principle features are similar to all such incorporating acts. A stock of $150,000 divided into 15,000 shares, at $10 each, is established. To this have been added 7,500 new shares, to increase the funds; the expenditures being necessarily far greater, than could have been foreseen. A great proportion of the new shares, yet remain in the hands of the company undisposed of.

The usual arrangements for procuring subscriptions prefatory to incorporation, are inserted. Three thousand of the original shares, are reserved, for the purchase of a site, and to establish a fund for freeing the bridge. Sundry clauses relate to the incorporation, organization of the Company and its officers, and mode of management of the funds. Power is given to the Stockholders to fix on the site; and, if necessary, to add shares, to encrease the funds. There is also a description of the kind of bridge to be built. The property of the bridge (and of such other property as they shall acquire for its purposes or convenience,) is vested in the Company for twenty five years, after the same shall be compleated; and the tolls to be taken are ascertained with great encouragement to the transportation of country produce and manure, and to the use of oxen for draft. Penalties are laid on taking illegal tolls, as well as on those who injure the bridge property or works, or impede the passage. The bridge is not to be erected "in such manner, as to injure, stop, or interrupt the na-

"vigation of the said river, *by boats, craft or vessels with-*
"*out masts;*" "and when the tolls shall exceed fifteen
"per cent, nett annual profit; the excess shall compose
"a fund, for the redemption of the bridge, so as to ren-
"der it free, save that there shall always be a small toll,
"or other revenue, for keeping it in repair; this excess
"shall be laid out in bridge Stock, or other productive
"funds, and the dividends, or annual product, shall be
"also added to this fund; and all private donations for
"freeing the bridge shall also be received and invested
"in like manner; but if by the operation of the fund
"herein proposed, there shall be a sufficient sum to free
"the bridge, at a period less than the said twenty five
"years, then it shall be redeemed and become free, on
"the Stockholders being paid the appraised value there-
"of, and of the profits thereof for the residue of the said
"term of twenty five years which may be unexpired;
"and if the said fund shall not be adequate to the pur-
"pose last mentioned, the legislature may, at the expi-
"ration of the said twenty five years, declare it a free
"bridge, (providing at the same time the means of keep-
"ing it in repair) and the Company shall be obliged
"to take such sum of money therefor, as shall be allow-
"ed on a fair appraisement by indifferent persons; the
"like appraisement shall take place, when the sinking
"fund is adequate to the redemption of the bridge and
"the establishment of a revenue, if a toll be not thought
"more eligible, for keeping the bridge in repair; but if
"the said bridge shall not be redeemed, and paid for as
"a free bridge, before or at the expiration of the said
"term of twenty five years, the said corporation may
"and shall continue to hold the same, on the terms of

"this act, beyond the said term, and until the same shall "be redeemed and paid for in manner herein directed."

As a general observation and interpretation of this clause, we insert an extract from a report of the building committee, 31st January 1803. "Our stock will bear "a comparison with any other, either in point of securi- "ty or duration. It is secured to us for twenty five years "after the bridge is finished. A period long enough to "gain a valuable profit. If it is made free, compensa- "tion must be previously made, by appraisement, for "both the bridge and its revenues. A circumstance, "however desirable, not likely to happen. The Com- "pany are to hold the bridge, after the twenty five years, "until they are amply reimbursed. The duration of "their tenure is therefore sufficient, and no loss of ca- "pital can occur. The bridge will be elevated above "all floods; and the piers and abutments of such strength "and solidity, as to place it out of all danger." And this latter promise of that committee has, it is confidently believed, been faithfully complied with.

In pursuance of this law, the then Governor, (*Mifflin*) on the 27th day of April 1798, incorporated the Company; the number of subscriptions, previously required, having been filled.

The Company was immediately organized; and the following named persons chosen according to law.

President, Richard Peters.

Directors, John Perot, William Sheaff, Joseph Anthony, John Dunlap, John Dorsey, John Miller, M. C. Matthew M'Connell, Robert Ralston, David Evans, junr. William Bingham, Samuel Blodget, Nathan Sellers.

Treasurer, Richard Hill Morris.

The first Building Committee were

Richard Peters, George Fox, William Sheaff, John Dunlap, and John Kean.

The general wish of the Stockholders, at the commencement of the project, was strongly in favour of a stone bridge. A draft of a stone structure, elegant, plain, practicable and adapted to the site, with very minute and important instructions for its execution, was furnished to the President gratuitously, by WILLIAM WESTON ESQ. of *Gainsborough* in *England:* a very able and scientific hydraulic engineer, who was then here, and from friendly and disinterested motives, most liberally contributed his professional knowledge and information, to promote the success of the Company. The foundations of the present piers, and abutments were laid nearly according to his plan, though circumstances compelled a considerable departure from it, as the work advanced. His communications were attended to with great advantage, wheresoever they could be applied. Having viewed the inefficiency of the eastern coffer dam—in the same spirit of liberality, he furnished to the President, a draft for the western *coffer dam*, before his departure for *England.* This plan was original, and calculated for the spot on which it was to be placed. It was faithfully and exactly executed under the care of Mr. *Samuel Robinson*, who was then Superintendant of the Company's work in wood. Mr. *Weston* foresaw great risques and difficulties, arising from the peculiar character of the river, and the nature of its bottom, in so great a depth of water. He declared, that he should hesitate to risque his professional character on the event,

though he was convinced that the whole success of the enterprise depended upon, and required, the attempt. Some idea of its magnitude may be formed, when it is known that 800,000 feet (board measure) of timber, were employed in its execution, and the accommodations attached to it. Sufficient in quantity for a ship of the line.

But it was soon discovered that the expence of erecting a stone bridge, would far exceed any sum, the revenue likely to be produced would justify. For this reason alone, no farther progress was made in the stone bridge plan. And though some other drafts, among them a very elegant one by Mr. *Latrobe*, were presented, the board of Directors were under the necessity of returning them, as being objects, however desirable, too expensive to be executed with private funds. It was therefore concluded to procure plans of a bridge, to be composed of stone piers and abutments, and a superstructure of either wood or iron. Mr. *Weston* at the request of the President and Directors, sent from *England* (after viewing most of the celebrated bridges there, and adding great improvements of his own,) a draft of an iron superstructure, in a very superor stile; yet with his usual attention to utility, strength, and œconomy, accompanied by models and instructions. Although highly approved, it was not deemed prudent to attempt its execution. All our workmen here, are unacquainted with such operations; and it was thought too hazardous to risque the first experiment.

The castings can be done cheaper here than in *England*, and with metal of a better quality, though the amount of the erection would in the whole, far exceed

one of wood. Mr. *Weston's* draft is preserved, and may yet be executed in some part of the *United States*; and it would do honour to those who could accomplish it. Finally, the plan so successfully perfected was agreed to; having been furnished by Mr. *Timothy Palmer* of *Newburyport* in *Massachusetts*, a self taught architect, who was employed to execute the work of the frame. He brought with him Mr. *Carr*, as his second, and four other workmen from *New England*. They at once evinced superior intelligence and adroitness, in a business, which was found to be a peculiar art, acquired by habits not promptly gained, by even good workmen in other branches of framing in wood. Both the materials and workmanship of this frame, are allowed to be remarkably faultless and excellent. It is also an evidence of prudence, in the President and Directors, in selecting a plan already practised upon, and workmen accustomed to its execution.

Previous to the decision upon the superstructure, the *piers*, without a certainty of the stability whereof, no superstructure could be attempted, were begun; with the intent, that when their completion was ensured, the Stockholders might be justified, with confidence to proceed in the work. There being no general engineer, the President and Directors were under the necessity of paying more attention, than is usually required in such cases. The President, with the assistance of a building committee, undertook the charge of the execution of this arduous work, requiring much attention as well in the outline as in its most minute details.

The President suggested, with the approbation of the committee, important parts of the plans of the ma-

sonry, and modes of securing the dams; and several improvements in the plan of the frame, which were adopted by Mr. *Palmer;* and occasioned a material difference from those in *New England*, and elsewhere, erected on similar principles.

The President's proposition and general design of the cover, were approved, and reported, by the committee. The opinions of a very great proportion of the Stockholders were at first opposed to this measure; though when perfectly understood, it was unanimously agreed to. Its novelty excited doubts and apprehensions, which time, and many violent assaults from storms, have proved to have been groundless. It will long remain an example for future similar undertakings; and is the only covered wooden bridge in the world, a much inferior over the *Limmat*, in the north of *Europe*, excepted.

Mr. *Adam Traquair* has merit in the draft of the cover, which he assisted to delineate. It was executed with singular fidelity and credit, by Mr. *Owen Biddle*, an ingenious carpenter and architect of *Philadelphia;* who made additions to the design. He has published an architectural work, entitled "The Young Carpenter's Assistant;" useful as an elementary guide, and which should be encouraged as an *American production.* In it will be seen a plate of this bridge, and a concise account of it; some parts whereof are herein repeated.

The whole of the masonary was performed by Mr. *Thomas Vickers*, who possesses not only integrity and practical skill, but is firm, constant, and prudently bold, in hazardous undertakings. His exertions were conspicuous on every emergency and casualty attending

the dams, and other dangerous and difficult parts of the work.

Those who with the President, composed the building committee particularly, as well as the other members of the board, and the Treasurer, meritoriously afforded every requisite assistance; as well when their aid was necessary in the executive business, as in a laudable attention to its pecuniary affairs. It always happens in such associations, that some pay more attention, and thereby gain and apply more useful intelligence than others.

It would be unpardonable, not to mention the *Stockholders*, with high approbation. Their advances have been great, and their patience under privations of profit, truly commendable. The amount of expenditures is nearly $ 300,000, though the dividends will be made on a much less sum (about $ 218,000) owing to the application of the floating bridge tolls, to the expence of the building. The company have evidenced a praiseworthy mixture of public spirit, with a justifiable desire of pecuniary advantages; in which it is to be ardently wished, they will not be disappointed. Although these advantages may be delayed, they are ultimately secured. Not the least gratifying, must be the satisfaction arising from the accomplishment of a public improvement eminently beneficial, as well in its use as its example, not only to those, who now enjoy its accommodation, but to posterity.

Common justice to the subject has compelled so detailed an account of this undertaking. Actuated by no motives of mere personal compliment, it is deemed of public utility to record for imitation, individual exertions, in cases wherein great objects have been accom-

plished by them, without any assistance from the public funds; and where the want of scientific and practical knowledge, was supplied by the constancy and singular attention of those, who possessed no more talents or acquirements, than are called for in the common affairs of life. Such successful examples are worthy of imitation; and will incite to perseverance, in laudable and necessary enterprizes; however apparently difficult and untoward; as many parts of this work have most undoubtedly been. Nor is it desired to recommend proceeding (where it can be avoided) in such hazardous undertakings, without professional engineers, both scientific and practical.

Few would have persevered under all the difficulties attending this work; which in its execution (unavoidably protracted by the embarrassments attendant on building under water) occupied six years after the law was obtained. However humble the merit of those who engage in such undertakings may be considered, they are far greater contributors to the happiness and convenience of mankind than those who, with victories and triumphs, dazzle while they desolate, and ruin and oppress the human race.

DESCRIPTION OF THE BRIDGE.

The *masonry* is executed on a plan suggested to the mason, uncommon, if not new. The walls of the abutments and wings, are perpendicular, without *buttresses*, and supported by interior *offsets*. These are found completely competent to support the pressure of the filling (which gravitates in perpendicular lines) without *battering* or *contreforts*. The abutments are 18 feet thick.

The wing walls nine feet at the foundations, retiring by offsets, till at the parapets, they are only 18 inches. The eastern abutment and wing walls are founded on a rock. Those on the western side are built on piles. The inclined plane of approach to the bridge, is elevated at an angle of 3 1-2 degrees.

Although the western pier has attracted most attention, that on the eastern side of the river, was first erected; and was attended with difficulties appearing often insurmountable. It is from 21 to 24 feet deep, below the tide, to the rock, on which the lower course is laid and bolted. The *coffer dam* was on a bad plan, though constructed as well as that plan admitted. Its materials were too slight and incompetent. Constant exertion, and repeated remedies for defects, were incessantly called for by frequent accidents. Every thing was new to all employed; but it was a school to teach experience. The footing of the piles was secured, and the dam saved from impending destruction, by an embankment of stone and sand, thrown around the bottom on its outside; and the latter washed in, and consolidated by the current. The same means were used at the *western dam*, and their utility decidedly proved. Both *piers* are of course, similar in their general configuration and composition. The first stone of the *eastern pier*, was laid September 5th, 1801. That of the *western pier*, December 25th, 1802. The time preceding was occupied in procuring plans, gaining information, and providing materials. These precautions, (always essential in great undertakings) forwarded the work, and ensured against delay and disappointment.

The *frame* is a masterly piece of workmanship; combining in its principles, that of *king posts* and *braces*, or *trusses*, with those of a stone arch. Half of each post with the brace between them, will form the *vousseur* of an arch; and lines through the middle of each post, would describe the radii or joints. There are three sections of the frame, all similar. That in the middle, divides the space into two equal parts, so that passengers in opposite directions, are prevented from interfering with each other.

The *platform* for travelling rises only eight feet from an horizontal line, and the top, or cap pieces, are parallel to this. Of the sections, the middle one has the most pressure, owing to the weight of transportation, being thrown nearer to that section than towards the sides; to which the foot ways prevent its approach. These foot ways are five feet in width, elevated above the carriage ways, and neatly protected with turned posts and chains. It has been conceived that the foot ways would have been more advantageously placed on each side the middle section, to throw the weight of transportation to the sides of the bridge.

Mr. *Palmer* (who is believed to be the original inventor of this *kind* of wooden bridges) permitted with much candour, considerable alterations in this plan, accommodatory to the intended cover, the design whereof is original. These were so much approved by him, that he considers the *Schuylkill bridge* superstructure the most perfect of any he has built. It was finished in one season; and declared open for passengers and transportation, on the first day of January, 1805.

The *Shauffhausen* bridge (which is now destroyed) much eulogised in *Europe*, was by no means equal to that on the *Schuylkill.* Any candid and intelligent architect, on inspecting the drafts of the one, examining the other and the principles of both, would give a decided preferance to the latter. The design of this is more simple, its strength is greater, its parts are better combined, and more assistant to each other: and there is no useless timber in any part.

The *timber* of which both the frame and the cover are composed, (the roof, of cedar excepted) is of the best *white pine*

The *flooring of the platform* is doubled, and in the whole 5 1-2 inches thick. The under course of *white pine*, 3 inches thick, is permanent, and well spiked and secured. The upper course is of sap pitch pine, slightly attached (2 1-2 inches thick) to be renewed as often as worn, either partially or generally, and with this the joints are broken. This mode of planking has been found, on the floating bridges, highly advantageous and economical. The under course admits of two or three removals of the upper, which wears before it decays. The floorings of wooden bridges are generally of single planks

The *exterior of the cover* is handsomely ornamented and painted. The under work imitative of stone, is well executed, by dashing the paint while fresh, with sand and stone dust. This is performed with so much ease and cheapness, that it is hoped it will introduce a like mode of ornamenting and protecting the surface of other wooden elevations. All apprehensions of scaling by frost, are proved to be imaginary.

A number of Conductors, properly disposed, secure the superstructure from danger by lightning.

All that could be spared for ornament, was expended on the exterior; as the interior neither admitted nor required it. The Pediments of the entrances were intended to be finished with Emblems of *Commerce*, on the east; and of *Agriculture*, on the west. They are designed, and were to be executed, by that eminent *American* naval sculptor, *William Rush* of *Philadelphia*; whose works as an artist, are admired, in whatever part of the world they are seen. It is desirable that this *finish*, the expence whereof will be small, should yet be added. The Pediments require it; to complete the design.

GENERAL OBSERVATIONS.

The *Schuylkill* Bridge Plan may be varied according to circumstances; and its principles preserved. In whatever varieties, projectors of other designs may indulge themselves, it is confidently believed that Mr. *Palmer's* plan will be found on long experience, to be the best. It is an unit in symmetry and movement; and all its parts support each other, like a *phalanx in tacticks*. In some instances Mr. *Palmer* has placed the platform for travelling, over the cap pieces and cross ties; or rather these latter become part of the frame of the platform. The great body of the frame is of course below. But this was not found eligible, where ice and floods were likely to assault the haunches, when the frame was thus depressed. The elevation of the abutments would require, for this plan, immense weight and expence of filling, and expose the walls to dangerous pressure. Nor

would it be so well calculated for heavy transportation.—More important than all—it would be unfit for *covering* to such advantage. Notwithstanding this great improvement, was highly approved by Mr. *Palmer* it was not in his contemplation, as to *mode*, until the outline of the present cover was shewn to him; although he said he had repeatedly, but fruitlessly, urged the measure of covering their bridges, in *New England.* It is hoped this example will be followed, in all pontifical wooden structures of magnitude, hereafter. Bridges may, for most situations, be less expensive in the frame; the middle section may be omitted above the flooring; nor need they be more than 30 feet wide. This width was deemed sufficient by Mr. *Weston*, for bridges in general; though he considered that over the *Schuylkill* to require more than common space, for its constant and burthensome transportation. The *Easton* bridge, built under Mr. *Palmer's* directions, is 28 feet wide; and the frame of the *middle section* does not rise above the platform. Its situation does not demand a plan, or call for dimensions, on a greater scale; and it is erected according to the *improved* work of the frame of the *Schuylkill* bridge.

Although the cover of the *Schuylkill* bridge compelled ornament, and some elegance of design, lest it should disgrace the environs of a great City; these would not be necessary in such a degree, in other situations. Neatness of elevation and taste in design, may be shewn at a small expence; and the workmanship and materials need be no more costly, than those for roofing and weather boarding common frame buildings. The *Schuylkill* bridge roof required one hundred and ten thousand shingles, of 3 feet long and 6 inches wide; and other

materials in proportion. Much of these may be saved, in narrower frames. The painting or coating, with the durable composition, in imitation of stone, which appears on the exterior of the work, below the platform, (for which a recipe is subjoined) may be done at a small expence. Mineral paints are the worst, for coating exposed to weather. The oil does not combine with the mineral, as it does with absorbent earths: and being extracted by the sun, leaves the mineral particles without adhesion, and they drop, or are washed away by rains, dews, and moisture. All oils or fats, are known, *chemically*, to be alike composed; and are better or worse, as they are or are not mixed with foreign matter. *Linseed oil* may be had every where, and fish oil is common. *Ochres* for colouring, (far preferable to minerals) abound throughout the country; and only require judicious exploration for their discovery. Clarified turpentine is a good substitute for oils; but a mixture of both is best. The less *forcing*, to accelerate drying, the better. Though inconvenient in some respects, the composition will be more durable, the longer it is in drying; but care should be taken, that it be not so thin as to *run*; or not retain the sand and paint. *Sea sand*, or earth mixed with marine salt, should be avoided, as being hostile to compositions or cements; and particularly when calcareous substances are combined. Some of the *Delaware* stone-cutters sand, used with the *Schuylkill* bridge coating, was found to be liable to this objection. We have daily before us proofs of this fact in our *plaistering;* where the hair of *salt hides* is used. Every moisture of the room, or atmosphere, brings out stains and damp spots on our walls; to which *papering* will not adhere, as it does on other plaistering,

into the composition whereof, salt hair does not enter. *Chemists* may account for this: but to them it is not yet clearly ascertained, from whence the *muriatic acid* is derived; nor are its nature, and properties, accurately known. Long and frequent experience has evinced, that the least mixture of this acid, or common salt,* with *gypsum*, produces a *tertium*, which renders it unfit for a cement; and also destroys its agricultural uses and properties.

RECIPE FOR COMPOSITION TO IMITATE STONE.

The work should not be primed; though part of that at the bridge was so done, before it was determined to coat it with composition.

The paint used was common white lead and oil; as the painters preferred their own way, and the scaffolding could not remain at risque, while experiments on other paints were tried. It was conceded afterwards, that if there had been time to prepare and use other paint, and the urgency of dispatch had not precluded delay for drying, *fish oil and clarified turpentine* with *ochres*, would have been more eligible.

* *Common salt* is compounded of the *muriatic acid*, and *soda*. The latter *substance* abounds in the ocean, and other places, where *common salt* is found. The *vitriolic acid* of *gypsum* meeting with the *muriatic*, in the *salt*, expels it from the *soda* of the *salt;* and having a predominant affinity, forms *sulphat of soda*, or *glauber salts*. Good *common salt* should contain *two thirds* of *soda*, and *one third* of *muriatic* acid; and is seldom pure in its combination, as to proportion; or absence of foreign matter.

As fast as the painter proceeded in his work, an adroit hand dashed on the sand and stone dust. This was mixed in proper proportions, as to colour and consistency, which is only to be known by preparatory experiments; easily accomplished. It was thrown on with a common tin dust pan. The sand and stone dust must be free from moisture, or any tincture from marine salt. It was dried in the sun, or a large iron kettle over a slow fire. A small proportion of *plaister of Paris*, was mixed with the sand and stone dust. A long trough containing the sand and dust, was placed under the work; and caught what did not adhere, so as to be thrown up again and prevent waste. The dispatch with which this operation can be performed, exceeded expectation, both as to facility and œconomy. With *marble dust*, it may be made to imitate that stone. As soon as one coat is dry, the other must be laid on. Two coats, well attended to, are sufficient. But this is left to the choice of those, who think another coat is required.

The joints are imitated by convex strips, sprigged on the weather boarding; and after the coating is put on, they are penciled off, with white paint.

The following is a *recipe* much followed, and with invariable success, for barns and other buildings, in the country: and being particularly applied to roofs, it is called "*fire proof.*"

Take 20 gallons of fish oil; boil it 4 hours over a slow fire; and skim it as the feculence rises. Put in it 12 pounds of rosin, or an equivalent proportion of clarified turpentine. Before taking it off the fire, mix ten gallons flax seed oil, boiled in the common way. Grind and mix with the oil, a sufficient quantity of *ochre* (of what

colour you please) to make the paint *thick* as can be well brushed on. As you brush on the paint, have your *composition* ready to sift, or dash on. It is thus made.—

Take one bushel of ground plaister, calcined over a fire in a dry pot, or kettle. When cold, mix with it 3 bushels of stone dust or fine sand, *dry*, and the more *gritty* or siliceous, the better. Sift or dash on, as fast as the paint is laid on. When dry, the second coat is applied in the same manner. Live coals, in quantities, have been thrown on roofs thus coated, without injury. It does not scale with frost, or melt with the hottest sun. The above is sufficient for a large roof.

The whole expence of the preceding composition including labour and laying on will not exceed $ 50.

	Feet.	In.
Length of the bridge, -	550	
Abutments and wing walls, -	750	
Total length, - - -	1300	
Span of small arches - (three in the whole number, including middle arch.)	150	
*Ditto of middle arch, -	194	10

* The middle arch was originally intended to be only 160 feet, but the dam could not be placed on the spot contemplated, owing to the bareness and inequalities of the rock at the bottom.

It is highly creditable to those concerned in the direction and executive branches of this work, that no delay ever occurred through want of supplies, or prompt payment. Yet one million and an half of feet (board measure) of timber, and above 22000 perches of stone, with all the subordinate and

	Feet.	
Width of the bridge, -	42	
Curvature of the middle arch,	12	The curvatures
ditto of small arches -	10	are catenarian.
Rise of the carriage way -	8	
Height in the clear over carriage way - - - - -	13	
ditto from surface of the river to the carriage way, - -	31	
Depth of water to the rock at the western pier - - -	41	
ditto at the eastern pier -	21 to 24	

Amount of toll when the work began for 1799, $ 5000
Present rate, (1805.) - - - - - - - - - 13000

The company have established commodious wharves, which were necessary for the safety of the abutments; and add greatly to the improvements of that front of the city.

President and Directors at the close of the Work.

President. Richard Peters.

Directors. John Dunlap, John Perot, Ebenezer Hazard, Thomas Savery, William Poyntel, Charles Biddle, Richard H. Morris, George Fox, Peter Browne, John G. Wachsmuth, George Reinhold. Anthony Cuthbert.

Treasurer. John Dorsey.

Building Committee. Richard Peters, William Poyntel, Anthony Cuthbert, John Dunlap, Peter Browne, George Fox.

auxiliary materials required, were employed in this structure. The labour, the cost whereof was a great proportion of the expenditure, was obtained below the common rate, in most instances; owing to the regularity and certainty of payment.

This account ought not to be closed without presenting for information, as well as to gratify curiosity, part of the report of the building committee, dated July 14*th* 1803. *Signed. Richard Peters, John Dunlap, Peter Browne, George Fox, Anthony Cuthbert.*

"That it was thought proper to begin the work of this season on the eastern side, by laying the foundation of the abutment, and raising the eastern pier to the height required for the first timbers of the wooden superstructure; so that the whole of the wood work will be elevated above all floods and substances which might injure it when floating on and carried with violence by high freshes. The highest fresh ever known having risen 12 feet 8 inches above high water mark, we have elevated the masonry 16 feet 8 inches above high tide; to guard against all danger. From five feet above the proposed spring of the arches of a stone bridge, where our cut stone ceases, we directed it to be carried up in range work, with hammered stone, as a facing; and the interior bonded with large, long and heavy stone, except at the end of the pier, up stream, where the cut stone is continued as high as any floating ice will probably assail it. The whole of the work is well filled, laid in common mortar and grouted, so as to compose a solid mass, capable of resisting the most severe assault from ice, floods or floating timber. The terras mortar and clamping, cease with the cut stone, about five feet above high water mark."

"When this pier arrived at its present height, the masonry of the eastern abutment was proceeded in; and so far completed, as to be out of all difficulty. We then directed the workmen to commence the raising *the western pier*. This had been carried up, last winter, within eighteen inches of low water mark. The dam having stood the winter without much injury, though roughly treated by the ice, was pumped out on the 27th day of May last. On examining the ma-

sonry with much attention we found to our great satisfaction, that there had not been the least alteration in the work by any accident. It had not settled an hair's breadth; but stood firm on its foundation, which we can now pronounce perfectly good, sound, and immoveable. We were agreeably struck with the perfect state of the whole masonry; which does great credit to Mr. *Vickers* the master mason. The tarras mortar used on the exterior is as hard as the stone; and the common mortar of the interior, as dry and indurated, though covered with water four months, as any cement, exposed in masonry to the open air for twelve months."

"We mention for the instruction of those who may have occasion to build where water covers or flows round the work, that rich mortar should never be used. Our common cement is composed of three parts sharp, clean, coarse sand, and one part lime. Sand is thrown into a bed of thin wash of slacked lime, and agitated till every grain is coated with lime, it then receives additions of sand till brought to its proper consistency for use. The grout is fluid, but composed of the like proportion of materials. The mortar used in the foundation once intended for a pier, near the eastern toll house, but abandoned as a pier, and now usefully employed, as the end of our wing walls, was covered more than a year with water. We had occasion to take part of it up. The mortar, having been improperly made rich, was friable, and had not the least tenacity or binding quality. The tarras mortar is composed of one part tarras, two parts lime and three parts sand."

"The western pier is now completed to the same height, and, except in depth, of the same dimensions with the eastern pier. The span between these piers is 137 feet 6 inches, from the piers to each abutment the span will be 150 feet each. No formidable difficulties have occurred in the work of the present season; and every thing has been conducted to our satisfaction."

"We think it proper to give a short description of this pier (the greater proportion whereof is invisible) that its structure may be known; and its embarrassing, expensive and tedious progress may be accounted for. We confine ourselves to the masonry—a description of the dam will be hereafter presented that it may be of service to others who may have occasion to use such auxiliaries, in aquatic structures. The plan of the dam, and instructions for its establishment, do much honor to Mr. *Weston* who furnished them. Mr. *Robinson* our superintendant, has great merit in faithfully executing this plan. But many dangerous casualties and unforeseen embarrassments baffled all previous arrangements; and required the immediate and unceasing efforts of the committee and the workmen to combat them. The members of the Board, and others of our fellow citizens, who voluntarily assisted us in endeavours to evacuate the dam of the obstructions which prevented our totally baring the rock, have our thanks for their exertions. These have afforded conviction that the plan we adopted for the foundation, was indispensable. The result has undeniably proved its efficacy, competency and permanence; and leaves no doubt of its being in contact with the rock; which though somewhat irregular, rises at the interior circumference of our dam and forms in the middle a tolerably regular cavity, well calculated to prevent (if the weight on it were not sufficient) any injury to, or movement of the foundation."

DESCRIPTION OF THE PIER.

"Not being able to arrive nearer to the rock than three feet six inches, without the most imminent danger of ruin, and failure in our object, it was deemed (after every effort to evacuate the dam had been tried) most adviseable, and dictated by evident neccesity to lay a rough foundation, before the masonry of cut stone commenced, about eight feet below the common bed of the river. This foundation was accordingly

directed by the building committee; and on the 25th of December 1802 began to be formed. It consists of large foundation and smaller stone intermixed. Roach lime and sharp sand cover and fill the interstices of each layer of these stone; which are all well rammed; and, reaching the rock, compose a solid mass, four feet thick, filling the whole interior of the dam; the area whereof is 42 feet six inches in breadth, by 92 feet in length. On this foundation, the cut stone was laid, and the pier shaped to its proper dimensions; which are here 30 feet in breadth, by 71 feet 6 inches in its extreme length; the ends being semicircular. It continues of these dimensions to the first offset, about four feet from the foundation.—There are six offsets to low water mark; each diminishing the pier about four inches; so that at that point it is twenty six feet eight inches in breadth and sixty seven feet two inches in length. There are from this point, to 18 inches above high water mark, three offsets, each diminishing the pier 10 inches. So that the dimensions, at this point, are twenty one feet eight inches in breadth, and sixty three feet two inches in length; the whole continuing semicircular at the ends. From this point the pier begins to batter and the cut stone ceases. The hammered stone, in range work, begins, and rising sixteen feet, lessens regularly to nineteen feet four inches in width, and in length sixty feet ten inches. When finished it will be in height fifty five feet nine inches from the rock, and will be neatly surmounted with cut stone, at each end, formed in the shape of a half dome. The cut stone are all clamped at every joint, with iron clamps, well secured. The outer ashlers are all laid in tarras mortar. There are a proper number of headers, dove-tailed in each course; running into the pier many feet. On these are laid vast rough stone, some whereof are twelve tons in weight.—These large stones of various sizes, are common in the interior of the pier, which is laid in a workmanlike manner, in common mortar, and properly filled with smaller stone; the whole being grouted and form-

ing a solid mass. Six large and heavy chains, are worked into the masonry, crosswise of the pier, at the foundation; and a large curb of timber, hooped with iron, surrounds the cut stone at this point. Fifteen other massive chains, fastened at proper places, with perpendicular bolts, well wedged, are dispersed in various parts of the pier, crosswise thereof, as high as low water mark. The whole masonry of the pier, was performed (including the winter work with all its disadvantages) in seventy four working days, after we had been seven months preparing and fixing the dam. Two months of this period were employed in incessant pumping, clearing and combatting casualties and impediments the most embarrassing and expensive. The courses of cut stone vary in depth, the least course being ten inches, and the largest two feet eight inches in depth."

"The foundation is further secured by the embankment of stone, intermixed and embodied with sand, thrown around the dam, on the bed of the river, to the height of fourteen feet. The interior piling will be cut off below low water mark, and connected with the pier by chains. Building stone are thrown in, between this piling and the masonry, about ten feet high, the whole forming a strong barrier against any attacks on the foundation."

"Had we foreseen that so many casualties, difficulties, and dangers would have attended our enterprise, we should probably not have hazarded the undertaking."

"We were convinced that the whole of our success depended on compleating this pier; and persevered against casualties and impediments, which frequently appeared insurmountable. It is at length accomplished, and the completion of our whole work thereby ensured. We mention, not as it respects ourselves, but for the emulation and encouragement of others, who may be obliged to encounter similar circumstances, that by perseverance, we have prevailed over the most discouraging obstacles. A pier of solid masonry, having

7250 tons on its foundation, which is twenty nine feet below low water mark, and at high tide, 38 to 40 feet deep, was began on Christmas day, in a severe winter, in a depth of water uncommonly forbidding, and in forty days carried up from necessity, during the inclemency of the season, to near low water mark; the point aimed at in our original design, for the work of an earlier and more temperate period."

"We knew our work was difficult enough; and the only structure of the kind in this country. But we did not know that it was so singular a proof of the effects of persevering industry in any country. In a letter from *William Weston* Esq. to *Richard Peters*, he writes:—

"*Gainsborough (in England)*
4th May, 1803.

"I most sincerely rejoice at the final success that has crowned your persevering efforts, in the erection of the western pier; it will afford you matter of well founded triumph, when I tell you, that you have accomplished an undertaking *unrivalled by any thing of the kind that Europe can boast of.* I have never in the course of my experience, or reading, heard of a pier founded in such a depth of water, on an irregular rock, affording little or no support to the piles. That the work should be expensive—expensive beyond your ideas—I had no doubt; the amount thereof, with all the advantages derived from experience, I could not pretend to determine; and if known, would only have tended to produce hesitation and irresolution in a business, where nothing but the most determined, unceasing perseverance, could enable you to succeed. However, now "all your toils and dangers o'er" I heartily congratulate you on the result: not doubting but the completion will prove as honourable to you as beneficial to the stockholders."

"We give this extract for the satisfaction of the stockholders; who must be convinced, that their money has been applied to an object of great difficulty and magnitude; in which expence was neither to be calculated or spared."

Nor should the following communication from the President be omitted: it contains facts and information, which we hope will satisfy all who are hereafter engaged in such structures, of the necessity of covering them.

"After many fruitless attempts by others, to raise funds, and institute plans for erecting a Permanent Bridge over the Schuylkill, I was fortunate enough, through many difficulties and much opposition, to obtain (owing to its own merit, urging on and assisting my perseverance) the law under which the erection of the present structure has been effectuated. I hold it therefore a duty peculiarly incumbent on me, who originated, and have faithfully laboured in the execution of an enterprize, in which so many have embarked their property, to make an effort for the completion and safety of a work, on which the value of their advances so materially depends.—Under these impressions, I bring before you the subject of *covering the Bridge;* and herewith present several drafts of covers, adapted to the frame. From the time of the first idea of a wooden superstructure, I have never wavered in my opinion of the indispensable necessity of the cover. I was surprised (a long time after I had conceived it to be a general sentiment) to find myself *in a minority* on this subject, though I was not entirely alone. I have reason now to hope that the sentiments of several of the Directors and great numbers of the Stockholders have materially changed; or returned to original impressions. I have been accustomed to this situation in many of the most important parts of the work, and subjects connected with it. I have now, as heretofore, waited for the candour of the Board and Stockholders to produce convictions; and have generally been gratified by the event. In some former communications it will appear, that I have never approved of *painting* or coating *with composition* or *resinous substances*, the surface of unseasoned or massive timber. I gave my reasons for this opinion, which

comport with long experience and observation, however singular it may appear. I endeavoured to prevail on the Board, or the building committee, to cause the straight timber to be *bored* through the heart; that the air might pass, and the *sap*, there evaporate; which, when confined, feculates, and sooner or later, rots all large timber.—Since this has not been done, I am not displeased that the timber is *splitting;* and, through crevices, giving opportunities of escape to this intestine and deadly foe. *Casing* of such timber with *lead*, *tin*, *copper* or *wood*, in immediate contact, and thereby closing the pores and preventing the emission of the *feculating sap*, I have endeavoured to shew to have been found, in most instances, worse than fruitless; because mischievous. Nothing has been proved so effectual, as covering the whole of a frame, constructed of large timber, with a roof; and, at the sides, excluding rain, without preventing an uninterrupted circulation of air. The cover I propose is calculated to be sufficiently strong for its own support; but if tempests, uncommonly violent assail it, the covering may blow away before the frame can be injured. The light *sails* may, by sudden squalls, be detached and yet the *ship* remain staunch. These causes of apprehension, have, however, never struck me with any force. Bare and improbable *possibilities* ought not to be subjects of reasonable and sober calculation. What is *certain* far over-balances *conjectural prognostics.—The bridge if left uncovered, will most assuredly decay in ten or twelve years.* Experience is the best teacher in all cases.—The modes of protection proposed in these drafts, have proof to support them, drawn from long and respectable experiment. Among others the *Schaaffhausen* bridge was a strong instance. It had been by its cover, effectually preserved from decay *for thirty eight years*, and was perfectly sound, at the time the French destroyed it. We have never heard of its being injured by tempests, though in a situation much exposed to them. In the eleventh report to the British Par-

liament, by the Commissioners of Land Revenue, dated February 6th, 1792, it will be found stated, from settled facts, that timber, secured in the manner here proposed, is of very long duration:"

"Ships built under cover are the most durable. In Venice, ships have, for a long course of time been built and preserved *under cover*. That practice has also been introduced into Sweden; and is mentioned by Mr. Necker, in his treatise on the finances of France. The Venetian ships of war are built and preserved from the weather while building, *under sheds* covered with tiles, resembling the roofs of houses; supported mostly by brick walls on each side, to defend the workmen in winter, from the inclemency of the weather; which walls are as high as the upper parts of the ships reach, and secured by cross-beams, high enough to admit of ships being launched under them. *The sheds cover the ships completely on both sides;* but are open at the stem and stern: only projecting a few feet farther out; and there they have temporary covers of boards to keep out the rain. *Eighteen* large ships, some pierced for 80 guns, *had been thus preserved, perfectly sound* (in 1792) *for fifty nine years*, under the sheds."

"I contrast with the foregoing facts, those I have collected on the subject of timber *generally;* and those relative to the uncovered wooden bridges in America, *particularly*. It is to be regretted that *all* these structures are thus destitute of the means of preservation. I now confine myself to the account of them I recently received from Mr. *Timothy Palmer;* in a letter dated the 10th of December last, in these words:"—"To some questions you put to me some time since, relative to the durability of *timber bridges, without being covered*, sides and top, I answer, from the experience that I have had in New England and Maryland—*that they will not last for more than* 10 *or* 12 *years*, to be safe for heavy carriages to pass over. The bridge near Newburyport, over the Merrimack, was built in the year 1792. It was repaired in

the year 1802. The bridge at Andover, across the same river, was built in 1793. It was rebuilt in 1803. Piscataqua bridge, near Portsmouth, (N. H.) was built in 1794. I believe there have been no repairs since, *except the Draw.* But I have lately been informed *it was much decayed*, and is to be repaired next season. The bridge that I built over the Potomac at Georgetown, in 1796, is not *safe for heavy teams to pass over.* Some have tried *paint* in the joints, others *turpentine* and *oil*, but all to no great effect. I am an advocate for weather boarding and roofing, although there are some that say I argue *much against my own interest.* Notwithstanding, I am determined to give my opinion as appears to me to be right. And it is sincerely my opinion, that the Schuylkill bridge will *last* 30 *and perhaps* 40 *years, if well covered.*—You will excuse me in saying that I think it would be sporting with property, to suffer that beautiful piece of architecture (as you are pleased sometimes to call it) which has been built at so great expence and danger, *to fall into ruins in* 10 *or* 12 *years!*" Need much be added on the subject generally, after these statements, and remarks of a practically intelligent, and worthy man."

"Never then conceiving, that any objections would be made to covering the bridge, I furnished several sketches for covers (as no person better qualified would do it,) contemporaneously with Mr. *Palmer's* drafting his plan; and always considered the cover as much a part of the plan, as the frame. Knowing the liability of timber uncovered to decay, I should not have thought it justifiable to invite subscriptions to our stock, unless I had taken it for granted, that the bridge would be protected by *some* cover. I prevailed on Mr. *Palmer* to suffer me to alter his plan, in several important particulars; with a view to my design for a cover. To this he liberally consented; and now considers these alterations to be valuable improvements; and has declared his intention to adopt them in all his future plans for bridges. The masonry too was

calculated by Mr. *Vickers*, agreeably to drafts furnished by me, for a cover similar to that marked No. 1. delineated by Mr. *Adam Traquair* from my sketches. I mention these facts, not with any view to individual merit, but to shew contemporaneous opinions; for I communicated every thing to those with whom I acted, as I occasionally met them. I presented an estimate (as correct no doubt as those generally are) calculated for this design: made at my request by Mr. *William Garrigues* and Mr. *Samuel Robinson*, then superintendant. It may be applied to any other with no great variation. It amounts to eight thousand dollars, a sum bearing no important proportion to the loss of capital, by the decay of the structure on which it has been expended. No. 2 and 3, are other designs for covers, which I have procured to be made. No. 2 is an improvement on the first sketch, made with the assistance of Mr. *Dorsey* and Mr. *Traquair*. Mr. *Owen Biddle* furnished the sketch No. 3."

"It is a mistake, in my opinion, into which some respectable gentlemen have fallen, that the timber will be benefitted by remaining, for a season, uncovered. The leakages during rains, or the meltings of snows, percolating through almost all the joints of the frame and the platform, sufficiently refute this idea. Every week and month this finish to our work is unnecessarily delayed, is an advance to ruin. No time should therefore be lost in preparations for the cover, which I have always considered as a part of the original plan; and not a new, or additional measure, though the exact design, or elevation, was not specially fixed."

"No person can regret more than I do, the unforeseen but inevitable expenditures of the stockholders. None can give them more credit than I do for their patience, under long and unpleasant privations. These will, however, now, with the success of our work, be remunerated. But it is their interest, and our duty, to secure what, with uncommon difficulties, and such heavy expences, has been accomplished. Their stock

will be appreciated, when the object of it is rendered in its *duration*, as well as other attributes, really *permanent*. It would be a reflection upon their understandings, and, with the knowledge we have on the subject, a breach of our trust, to practice a dangerous and false œconomy, and thereby incur the penalty of certain destruction. I beg the excuse of the board for giving my sentiments at length on the subject. It is one on which I thought it my duty, whatever may be the result, to be explicit."*

RICHARD PETERS.

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* The following notes, omitted to be inserted in page 40, are here added.

"*Grouted.*" *Grout* is mortar of the same proportions, in its component parts, with that used in the common way. But this is in a *fluid state;* and, from time to time, poured on the courses of masonry, as the work is in progress. It searches out, and fills, every vacancy; and completely embodies the mass. All masonry, faithfully built, should be thus treated. *Contract work* is too often slighted, to save the materials of common cement; brick walls as well as those of stone should be *grouted*. In large works it is peculiarly necessary.

"*Tarras*" is a species of *lime*, procured from *Holland* (called *Dutch tarras*) and several parts of the *European Continent*. It has the quality of becoming insoluble (or hardening) under *water;* like *common lime*, in *atmospheric air*. It is a substitute for *Puzzolan* earth, found in *Italy*, in the vicinity of *Volcanoes*; it being *volcanic* matter.

Welch Lime, in a considerable proportion was used; a sufficient quantity of *tarras* not having been procured, and no difference, in their qualities or effects, was perceived. This *lime* is found on part of the coast of *Wales;* and is said to be thrown up by the *sea*, on its shores. It is believed to have *calcareous matter* (which abounds in the ocean, as well as in the earth) for its basis, combined with *fixed air* or *carbonic*

Address of the President and Directors at the close of the work.

"At the close of a work so important to you, and so advantageous to the community, as that of the *Permanent Bridge* which we now deliver over to our successors, in a state to every useful purpose complete, it might be expected, that some specific enumeration of its various difficulties, and the impediments which rendered it dilatory and expensive, should be given. But in the course of the undertaking, every circumstance, worthy of notice, from time to time occurring, has been detailed and published in the reports of our Building Committee; with an attention and constant regard to correctness of representation, which has marked their conduct, from the commencement to the end of this arduous enterprize. The whole has been under the view of the Stockholders, who have evinced their approbation, by continuing in the exercise of the trust confided to them, the President and the major part of the Directors, as they were originally chosen. This mutual confidence has animated us in the discharge of a duty, often laborious, frequently perplexing, and always exposing us to responsibility for measures, taken under emergencies, sudden, difficult, imperative, and requiring large and unlooked for expenditures. The whole was new to us; and some parts of the work unexampled in any country. We could obtain, in exigencies the most pressing, no immediate assist-

acid; as is our common lime stone. But no analysis was made; its effects only being the objects. In the *Spanish West India Islands*, they use marine productions in cement, for *coating* or *rough casting*, impervious to water, or moisture. They may, possibly, be of the nature of *Welch lime:* and, with careful search, such useful substances may be found on our shores; or, in our country, *tarras*, or some earth of similar qualities may be discovered. In *Jamaica* they have an earth, which answers every purpose, of either *puzzolan*, or *tarras*.

ance, from persons either scientifically or practically skilled, in some of the most difficult and dangerous portions of the erection. We were therefore under the necessity of proceeding, with such auxiliaries as we could obtain (in which we have generally been peculiarly fortunate) and risquing both public opinion, and the funds of our constituents, on the result."

"In situations the most hazardous and untried, we had not the encouragement or consolation of *general opinion*. We laboured with persevering industry *against it*; knowing, as we did, that our fellow citizens had even less experience to direct their judgment, than ourselves. We were satisfied that our object was worth the boldest attempt; and that without the accomplishment of what really was, as it appeared in its earliest stages, the most arduous part of our project, the work must be abandoned. Success crowned our perseverance. From this we claim no other merit, than that of having set an example to others, who may be engaged in works so unpromising; attended with similar risques, and affording only a choice of difficulties. In our situation, what in the common course of things might be stiled *œconomy*, would have been ruinous parsimony. Yet whenever real *œconomy* could be practised, we have regarded it with the most scrupulous attention. A very great proportion of the expenditures, was forced upon us by inexorable necessity. The fruits of them are, for the most part *invisible*; large disbursements having been inevitably applied to the coffer dams, in all their variety of casualty and dangerous vicissitude—to the subaqueous, expensive, and difficult parts of the piers, and the foundations of the abutments. Participating, ourselves, in either the success or failure of the design, we relied on the candor of our fellow Stockholders. Impressed with a conviction of having acted from motives the most upright, we trusted, in every event, in their sense, and our consciousness, of our integrity of intention, and unremitting regard to our duty. These are all

the observations we deem necessary, as they respect unavoidable expenditure. We have made them, as we shall make others, not because we deem ourselves under any necessity of justifying our conduct; but to recall to your recollection, for your own satisfaction, past circumstances, which have attended the great work you have so meritoriously supported; and to fix your attention to future prospects."

"As to what regards the other solid, durable, and *visible* parts of the work, and the mode of performing it, as well as those which may be deemed *ornamental*, these must be left, for inspection, to the structure itself, which will furnish its own eulogy. We are happy to believe it meets with general approbation. We have, throughout, studied simplicity, strength, and durability; and have expended on ornament no more than our sense of propriety justified. We could not suppose, that those who had so laudably suffered privations of immediate profit, were so absorbed in calculations merely pecuniary, that they would have been contented with a fabrick disgraced by savings unseemly and sordid. We considered ourselves bound to exhibit at the entrance of our city, a structure worthy of the place of its establishment. We were supported in every thing relating to the novel, but, in our opinion, elegant exterior of the cover, as well as in the measure itself, by the express approbation of a most respectable meeting of Stockholders. The draft by which it was executed (some necessary additions, and indispensable, but not extensive alterations excepted) was at that meeting, produced and examined. It fully answers our expectations: and appears to have satisfied those who originally entertained objections against it. This finish not only adds beauty, but affords protection, to a structure which will very long remain a monument of public spirit, as well as a testimony of persevering, successful, and well directed private enterprize. It will also, at no distant period, amply retribute all pecuniary advances. Our tolls have already nearly trebled in nett amount. They continue to

advance, from causes now in operation. From circumstances only beginning to have influence, we are justified in calculating, not only on a steady and customary increase, but on a progress accelerated in a flattering degree."

"Apparently supplementary, yet essentially connected with our object, are the capacious and highly commodious *wharves*, we have deemed ourselves warranted in establishing, on both sides of the river. On mature consideration, we found them absolutely requisite to the security of our abutments; especially that on the western side. On that side considerable improvements and business are commencing. On the eastern margin of the river, and in its vicinity, a new, healthy and incalculably valuable front to this great and opulent city, is rapidly rising into importance and extensive utility. Every part of our undertaking, so successfully accomplished for our own benefit, gives also a forcible impetus to the efforts of others. Their improvements add value to the bridge property; and greatly encrease the revenues of the Company. Thus will the advantages resulting to others, from our spirited labours and expences, most profitably reverberate on ourselves."

"We lay before the Stockholders our accounts from the commencement of the work; classified in detail, as accurately as the mass of matter, and the extensive range of the business, will permit. Our books and minutes are ready for inspection. *Our* time and anxieties have been occupied in the erection. A *future Board* will have leisure and opportunity, and, from the encreasing revenue, we trust, *means*, of placing the pecuniary affairs of the Company, on a footing profitable and easy."

"We beg leave to present our sincere gratulations on the success of an undertaking, commenced under circumstances very discouraging; and completed with every prospect of well earned emolument. Of its stability, we have not the most distant doubt. We know its materials are so well selected;

and its workmanship so faithfully executed, that, both the quality of the one, and the excellence of the other, will bear the test of the most critical and rigid examination.

Signed by order, and in behalf of the Board,

RICHARD PETERS, *President.*

December 26th, 1805.

The following is a short statement, of the situation of the Stock. 1806.

Original Stock. - - - - - - - -	15000 Shares	
Additional. - - - - - - - - - -	7500	
	22500	
Shares authorized to be issued; but not used. - - - - - - - - - -	2000	
		24500
Whereof, are completed, and certificates issued. - - - - - - -	19567	
Remain on hand, not sold or subscribed	4933	
		24500

Stock issued, 19567 Shares at $ 10 each, is $ 195,670

So that a clear revenue of $ 12000, will pay more than 6 per cent discount: and this will happen, when all the debts are paid. These are now funded; and interest paid regularly. They must be gradually discharged.

A small proportion of shares forfeited, are unsold; but these go to the credit of the Company; and lessen the aggregate on which dividends are to be struck.

When, by the rise of the Stock in the hands of the Company, it can be disposed of, so as to commute the debt for Stock; or to pay it with proceeds of Stock subscribed for, and delivered out of that remaining on hand; then the Capi-

tal on which dividends will be made, will encrease by the addition so made. The sum mentioned in page 28 (218000) as being the probable amount, was conjectural, and is not exact. The following is as correct a statement as can now be made; though it may not be entirely accurate. It is founded on the probable result of the year 1807.

Number of Shares completed on which dividends will be made is 19567 at $10. - - - - -		$195,670
The sum funded, or borrowed on loan, is $42000		
Interest at 6 per cent. is - -	$2520	
The probable contingent expences of every description. -	2356 67	
The Revenue for 1807, will be $14000, at least		

Although the Revenue is fluctuating, according to circumstances annually occurring, yet it has, on an average, constantly progressed in an encreasing amount. This will be seen by recurring to the sum produced by the floating bridge, as heretofore mentioned, and that now arising from the tolls of 1807. There is yet a small proportion of unliquidated debt.

COFFER DAMS AND PIERS.

It is almost impracticable to give an intelligible description of a *coffer dam*, without technical language, and a draft or model. It is calculated for excluding the water of a river, in which a *pier* is to be erected on a stable foundation; and for this purpose, to give access to the bottom, or bed, with safety; and, without danger or impediment, to ensure the accomplishment of the work. It is a *fixture*, and entirely different from a *batterdeau*, which is a tight vessel or box, in which the masonry is carried on as it floats; and, being at first

calculated for the depth, or raised upon as it sinks with the weight, it finally arrives on a level bottom, or bed, (which is indispensable) or on a *grating*, (supported by piles, driven into a pervious and deeply covered bed,) accurately prepared for its reception, and permanent station. When it is thus fixed, the sides of the *box* are detached, and the masonry is exposed: the bottom of the *batterdeau* remains under the masonry, either on the bed of the river, or the *grating*, prepared for it.

The *coffer dam* for the *western pier*, was composed of two ranges of piles; some, much larger than others, called *main piles;* and between these, less, or *sheet piles*, were driven. The ranges were nine feet from each other; embracing, within the interior range, an area, several feet larger than that of the lower course of the masonry of the pier. They were connected by *cross ties* placed horizontally; and the space between them was filled with loam, or earth, and called *puddle;* consolidated from the bottom, or bed, of the river, to a height above the tide; and forming an embankment of this *filling*, so as to exclude and resist all access of water. The piles were about 42 feet long; and, being sharpened, and shod with iron, at the lower ends, were driven (where the cover on the rock would admit) by the heavy *ram* of a powerful *pile engine*. They were neatly worked and jointed, and united with each other by *tongues and grooves*. The ranges were secured by horizontal frames of large timber, well strapped; called *belts*, of the shape and figure of the dam; which had six sides. These *belts*, which were double, to receive the *piles* between them, were alike in both *ranges;* and connected with each other, as well as with the *gratings* and

cross beams, which were horizontally placed inside the dam, to resist the pressure from without, as the *belts* were calculated to sustain *that of the puddle;* the whole united together, like a floor of joists. The lower *belts* and *gratings* were first sunk, as near the bed of the river, as its inequalities would permit. The others, to the number of five, or six, were sunk successively, with the correspondent *gratings*, at proper heights or distances from each other; secured, at first, by *anchors* and *cables*, and finally fixed by *main piles* driven by the *ram*, so as to form a *skeleton* of the whole dam; which was thereafter *embodied*, by driving the *sheet piles*, and filling in the *puddle*. After the dam was completed, the water contained in it was pumped out; and the pumps continually kept at work, while leakages required. The foundation was laid for the pier, as soon as the dam was evacuated of most of its contents. But a long course of labour, danger, and apprehension, occurred, before this was accomplished. As soon as the masonry arrived at the *gratings*, successively, the exact shape and size of the pier were cut away. The parts of the beams, and other timber of the gratings remaining, bearing against the stone work had their full effect in supporting, and keeping the dam in its place.

The great *desideratum*, in such works, is to have some *pervious* substance, as a *footing* for the piles, and sufficiently sound and tenacious, to prevent *bottom leakages*, or *blowing*, which are often fatal. The advantages of such *footing* were denied, in many parts, by the bareness of the rock, on which the pier is founded. Owing to this untoward circumstance, *under leakages* constantly annoyed and threatened. A well intended, but mis-

taken endeavour, to evacuate *all* the silt and mud out of the dam, was arrested in time to save the whole from ruin. The balance to the pressure of the exterior head of water, was perceived to be on the point of being destroyed: and the attempt at a total removal of the whole contents of the dam, was fortunately discontinued.*

* The success attending the first, or *eastern* foundation, being laid and bolted *on the rock*, inspired an ardent wish in all interested in the work, to arrive at it, for the establishment of the *western pier*. Difficulty and danger were overlooked; and only the object regarded. When the dam became incessantly leaky, and the more so as the mud was evacuated, a Committee of experiment was joined to the Building Committee, at their request. Nothing could exceed their joint exertions, but the laudable zeal with which they were animated; and several of the Stockholders voluntarily rendered their assistance. But this zeal had nearly ruined the object of it; a considerable time before the close of these well intended efforts, the President (who, by constant attention, was minutely acquainted with the principles and construction, and, of course, the *fort* and *foible*, of the dam,) became uneasy; and intimated to the mason, that the prosecution of the attempt, at the total evacuation, was dangerous in the extreme. The mason was convinced that the opinion was correct; and the superintendant declared he had long been apprehensive of the consequences. Under the hope that this would be soon perceived by others, a plan of the present artificial foundation, was communicated by the President to the mason; and by him digested. It was mentioned with candour and caution; but received with decided disapprobation, by the greatest number. The industry and redoubled diligence of the Committee, were viewed with painful solicitude. At length, the critical period arrived, when it appeared highly probable that

The *under leakages* were highly alarming and ceaseless.

another day's work would have defeated the whole enterprize. It was known that nothing but actual perception of the consequences, would bring conviction; which all reasoning (resisted by the strong desire to reach the rock) had failed to produce. Several of the stoutest labourers were set to work, with a view to dig a pit, to the rock; which was not more than 3 or 4 feet from the then surface. They had not pierced the mud above half its thickness, before a column of water, copious and alarming, suddenly gushed up. This produced an immediate conviction, of the unjustifiable hazard of any farther attempt to bare the rock: and the factitious foundation, being, without farther hesitation, agreed to, was forthwith commenced. The principles on which this occurrence was predicted, appeared to be proved; not only by this specimen of the effect of admitting even partial avenues for the water, but in the progress of the masonry.—After the foundation was completed, the leakages lessened very perceptibly. As the work proceeded daily, the leaks decreased: so that, in a few days, either *Clymer's*, or the *chain pumps*, could free the dam; and at length pumping was intermitted, for long intervals, entirely. Thereafter to the close of the work, the *chain pump* was sufficient; and only occasionally employed. The water flowed round the work, during the time of laying a few of the first courses of the masonry; but afterwards it remained below, and was harmless and manageable.—Some advantage, no doubt, accrued, by the compactness of the foundation filling the dam. But there always had been dangerous and constant leaks above this; which, until the pressure of the external head of water was fairly conquered, and entirely overbalanced, by the additional and daily encreasing weight of the masonry, never ceased to flow, copiously and perilously. The exertions of the Committee were not only meritorious in their motive, and facilitated the lay-

The dam could always be pumped out, as low as 30 or 33 feet, with ease. *Probably*, the column of air, equal to the area of the dam in its base, assisted the substances remaining in the dam, to balance and resist the exterior pressure; which could not be overcome to a greater depth by any efforts, until the *puddle*, and the *outward barrier of stone and sand* (hereafter mentioned)

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ing the artificial foundation, but proved, incontestibly, the unavoidable necessity of the step. And this was a point of no small importance, in a work which depended so much on public opinion, to induce farther advances for its prosecution.

The dam was so pressed, and became so critically debilitated, towards the last stages of the evacuation of the mud and silt, that the breaking of a single *cross beam*, had nearly wrecked it. This beam broomed and splintered; and in its diruption, with a loud and violent explosion, shook the dam throughout. Another beam which resisted the pressure on the failure of this, had been fortunately saved from being cut, to admit a pump. The weakening, or cutting this, would have gone far to compleat the destruction. Thus perilously uncertain are *coffer dams*, on the best construction, in deep water, and with little, or partial footing for piles.

These circumstances are detailed, to shew the true state of things, with which many Stockholders were unacquainted; and were, in consequence, dissatisfied, because the first course of masonry of the western pier, was not laid on the rock. They supposed, though experience has proved the contrary, that the artificial foundation would be found incompetent: and some yet conceive, the rock could have been bared without danger.

The statement will also serve as a caution, to all who in future engage in such difficult tasks, to avoid, however desirable the object, the ruinous consequences *of doing too much*.

had acquired the last degree of consolidation and settlement: and even then it was uncertain and hazardous; as appeared by the result of the attempt before stated.

During the erection of the pier, a great number of workmen and labourers, were employed. Those engaged within the dam, at the masonry, working without apprehension of danger, sometimes by the light of many lamps and lanterns, on the bed of a deep and often rapid river, in an enclosure of complex and stupendous construction, incessantly pressed by a formidable head of water, exhibited, in connection with the busy scene above—an interesting spectacle—curious—novel—and entertaining: yet, at times, when dangers threatened, or casualties occurred, not unattended with perplexing and serious anxieties.

Extracts from a report signed by the superintendant *Samuel Robinson*, (who with the master mason *Thomas Vickers* formed these reports) are subjoined; dated November 17th 1801. There are several of these, containing a curious history of difficulties and details; some whereof exhibit useful instruction. They will shew *some* of the embarrassments, but by no means the whole, attending the *coffer dams*. They will serve as *guides*, in future undertakings of this kind, or *beacons* to avoid their use, if it can be dispensed with, however here they were unavoidable. European engineers would have startled at placing dams on rocks, which, though partially covered, were in many parts bare, or so scantily overspread with mud, or any tenacious substance, as to afford no footing for the piles. Yet they succeeded, in untaught but persevering hands; whose *zeal* knew not professional caution, overlooked danger, and supplied

the place of practical talents. The expedient of forming an artificial embankment of stone and sand, promiscuously thrown around the footing of the piles, was attended with compleat success. It saved the *eastern*, and was essential to the security of the *western* dam. Many hundred perches of stone were used; and great quantities of sand; which, having been washed in by the stream, consolidated the mass which now forms a perpetual protection to the foundations. Both these dams were exposed to ruin; by the cross ties connecting the inner and outer walls, or ranges of piles. The space between them was filled, or puddled, chiefly with loam, found to be the best filling. The ties were horizontal, and of large timber; permitting, under each of them, a sinking or settlement of the puddle; which afforded channels, or courses, for constant streams of heavy leakages; which were, with great difficulty, kept under by many pumps. These pumps were worked by horses, and labour of men. They were ingeniously contrived; one of them (far superior to the best chain pump) was made by *George Clymer* of *Philadelphia*, a self taught mechanic; capable of throwing out 400 gallons per minute, and not subject to choak with sand, or even small pebbles, chips or filth. This pump voided nearly half the water evacuated from the dam. Twelve hundred gallons per minute have been (when hard pressed) ejected by all the pumps; commonly 600 to 800 gallons, when the head, encreased by the tide, augmented the leakages. The mischiefs attendant on the ties, were the only faults experienced in Mr. *Weston's*, otherwise perfect, and really admirable, plan of the *western dam*. The *eastern dam* was quadrangular; the *western*, hex-

agonal; the salient angles acute; and pointing up and down the stream.*

The report also shews, how little service was afforded by our most ingenious mechanics, out of the line of their several trades. With the best dispositions, many, as well mechanics as other citizens, suggested remedies for misfortunes, or supposed guards against them. Some assisted in executing their ideas in both dams, but not a solitary attempt succeeded. The Company are not the less obliged; nor is it any reflection upon them, as they had as little experience in such undertakings, as those whose duty compelled bold and hazardous measures, on which, even professional men, versed in hydraulic mechanism, would not have risqued their characters.

* *Hemlock timber*, (*Pinus Abies Americana*, LIN.) had nearly defeated the *eastern dam*: much of it was used, on account of its cheapness. But it always gave way, when hard pressed; and its failure, at several critical times, was nearly fatal. The *belts* (which serve to a *dam*, the same purposes as *hoops* to a *cask*) frequently broke; owing to their being of this wood, and flinty, or curly, in spots. Straight grained *hemlock*, entirely free from *curl* or *flint*, is seldom to be found; though some varieties are better than others. But this timber never should be depended upon; either for strength, or durability. It was excluded from the *western dam*. Some *hemlock* is very durable; but the appearance of this wood, is so generally alike, that it is imprudent to risque the chances of hitting on the kind required for lasting, or strength. Perhaps there may be some stages of growth, or time of felling, as it is with other woods, more or less favourable to durability.

These extracts are calculated to give a general idea of the difficulties, unavoidable expence, and magnitude of these all essential parts of the undertaking. A detailed and accurate description would extend to a greater length, than is contemplated in this communication; though drafts and notes, for the purpose, are preserved.

EXTRACTS.

Schuylkill Permanent Bridge, Nov. 17, 1801.

" Gentlemen of the Building Committee,

" In compliance with your directions of the 13th October, I now lay before you a statement of the expence incurred in erecting the (eastern) *coffer dam.* At the same time I beg your indulgence while I point out some of the difficulties with which we had to combat. When Mr. *L*——," [the first mason and superintendant, who misled the committee into an inefficient plan of the dam] " was consulted with respect to this dam, he could give us no useful information, or assistance. But in this case, as upon all other occasions of difficulties, we found great assistance from the *acting members* of the Building Committee. We explained to them our objections to raising the dam, on the proposed plan, of the three rows of piling, which were contemplated. We wished to throw off one, *as there was not sufficient hold at the bottom*, to resist the great pressure of such a puddle; we were afraid of its bursting outward. A member of the committee, [the president] proposed forming, at the bottom of the river, around the sides of the dam, a barrier of common building stone and sand, which when raised nearly to low water mark, he thought would be of great service. The plan was approved of and executed, and we found it to answer the purpose completely; not only of keeping the dam in its place, while we proceeded in finishing it; but was of great use, throughout

the whole progress of the work. When the dam was sunk, notwithstanding all the precautions we took, it burst open at the South West corner, we then had recourse to clamping it." [Mr. *R*—— then proceeds to give a detailed account of the means taken, with the advice of the committee, for securing the dam. It, however, burst again, and other remedies were applied, so that they began to *puddle*. Preparations were made for pumping, and caulkers were employed to caulk the joints of the sheet piling, which was not only weak and without substance of timber, but was not ploughed, tongued, or grooved. The leakages increased, and some of the puddle was dug out, and the residue rammed; yet the leaks continued *along the pile ties*, which upon every trial were found to be the cause in a great measure, of the misfortunes, from the bad construction of the dam. Remedies were applied, but still the evil prevailed. Caulking began to be efficacious, and enabled them to pump out the water, and see the long looked for bottom of the river.] " When the water was nearly out of the lower side, the dam suddenly gave way at the bottom, caused by the pile-casing being cut square, and not accommodated to the rugged and uneven bottom." [The blowing of the dam and bottom leakages were alarming. Plans to counteract this evil were projected, and applied with great labour and exertions. The chain pumps were worked by horses. Expectation was raised, and suddenly disappointed. The dam gave way, behind the chain pumps, which however, " were kept at work by the labourers with great resolution" until the carpenters had secured this part of the work; and the chain pumps continued at work, and the difficulty was overcome. He then states the reasons why the disasters occurred; which are attributed to the radically bad plan of the dam, which was now amended " by throwing off the outside row, and *substituting* " *the stone barrier in its room outside;* and the *puddle* inside, which *answered the purpose effectually.*'] The report proceeds to state that,

"On the 5th September the first stone of the pier was laid. This day we fortunately kept the water out all day; the masons *worked* 13 *hours without refreshment;* except a little drink. We were now unanimously of opinion, that our difficulties could be overcome; nevertheless, we were obliged to work night as well as day, when the tide answered," [the leakages always increased, owing to the greater head of water at high tide] "until we got above low water mark. We were then at ease; but little pumping afterwards. The *water shoots*,* laid in the dam, served to regulate the tide afterwards on all occasions, until the masonry was finished."

* *Water shoots* were *tubes*, in the first, and *trunks* in the second dam, furnished with *valves*, or *shutters*, so as to permit the *exit* of water, but to repel its *entrance*, and to be opened, or entirely closed at pleasure.—They were placed just above low water mark; and while the dam was filling with puddle, suffered to remain open for the flux and reflux of the tide; or shut when circumstances required. The dam could of course be always emptied to low water mark, without pumping; and by closing the shoots, the tide was entirely excluded. But a great length of time elapsed, while the puddle was filling, and consolidating, before it was safe entirely to exclude the tide. The water, inside the dam, was a great counter balance; not only to the pressure without, but to that of the settling puddle. None but those who have experienced it, can conceive the almost resistless force of earth, while consolidating: and the puddle of these dams consisted of several thousand cart loads. The admitting and excluding the water, required great care and judgment; and frequent trials were made, before the risque was encountered of the entire exclusion of the tide. Before the earth of the puddle was sufficiently embodied, to sustain itself, the work had to support not only its weight, but the immense force and irregular protrusions and pressures, of parts differently composed, and settling faster or slower than others.

Every kind of earth, or substance, any wise proper, was tried for *filling* or *puddle*.

Crude brick or *potter's clay*, settled unequally, and cracked when otherwise consolidated. Tempered clay was little better.

River mud was bad; it had some of the properties of clay.

Gravel, was good for the filling of the abutments; but not proper for the dam. So was it with sand.

"We would be ungrateful if we did not here express our obligations to those members of the committee; who by their personal attention and counsel, wherever it was necessary, contributed, in a principal degree, to the final success of our undertaking; which had all along been attended with great risque; and inconceivable difficulties. But from them, and from our own discoveries, which were accidental, we derived much assistance. The variety of schemes suggested by those who occasionally gave their advice and opinion, though gratefully attended to by us, were of no manner of service. We mention this merely to shew, how little capable of judging are those, who only partially attend to such subjects; and are not practically engaged therein. In case of failure, our having attended to every thing of this kind which have seemed to be of any use, would have been a great consolation to us."

The expence of erecting the *eastern dam* is detailed; and amounts to $ 9491 38 cents.

(Signed) SAMUEL ROBINSON.†

Smith's or *furnace cinders* were very useful in stopping *ground leaks;* but a sufficient quantity could not be procured.

After all these were carefully used, in every way, the common *loam* or earth, free from roots, stones, or foreign matter, was preferred; and found perfectly competent. That under the vegetable mould, was the best.

† The *eastern dam* narrowly escaped being rendered abortive, and the project stifled in its infancy. A most important *beam*, running longitudinally (like a main girder, in a large building) and on which depended many smaller *ties*, ramifying from it, was designedly, and wickedly, sawed nearly through, with a fine saw, on a Saturday night, at a time of swift water, to expose the dam to the dangers of the next day of intermission from work. It was luckily discovered early the next morning, in time to guard against the ruinous consequences. No discovery was ever made of the perpetrator. It was known but to a few, and kept secret (among other reasons) to preclude alarms in the stockholders; whose apprehensions were sufficiently alive from causes arising from common circumstances. Where advances of money are required, by voluntary payments, no unnecessary terrors need be raised. Some thought the first loss would be the best, and suffer-

The plan and execution of the *western dam*, were in perfect contrast with those of the eastern. But the difficulties were also incalculably great, owing to the depth of water, and magnitude of the work; and the expence was in proportion. It would occupy too much room and time to do justice to the subject; which would be instructive, as well as monitory. The only *hydraulic carpenter* of any experience, gave up the work, at an early stage of it, as hopeless; and disgracefully abandoned it, in despair. An ingenious *machinist*, who had been the principal dependance for machinery and work in wood, was killed, by unaccountably getting under the ram* of the pile engine of the western dam;

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ed their first instalments to be forfeited, prematurely foreboding the worst. Some invidious and illiberal persons wished ill to the undertaking; as had appeared on various occasions. In this age of speculation, many *bets* were laid, for and against the final success of the enterprize.

The stroke was aimed at a vital part, if the expression be allowable, and it was adroitly executed. Conjectures were suggested, but none could be verified. But whether it was done from mere mischief, or motives, illiberal or sordid, will never be known. It had however, the good effect of producing caution. A guard was thereafter kept, and a watchman is yet employed, constantly to watch the work. This should not be neglected in all such undertakings. Such malicious injuries are generally committed, by the vilest members of society; and none others could be suspected. Slaves, depraved children, and cowardly offscourings, generally perpetrate secret mischiefs: and it is often indiscreet to take too much notice of them; as the hidden perpetrator may not be discovered, and others may take the hint. This is now mentioned, because some have thought, that more publicity should have been, at the time, given to the circumstance. Its monitory uses, give now its only importance to this fact.

*This *ram* weighed about 750 pounds. One of almost double the weight was, at first used. It was soon found, that a too ponderous ram defeated the object of it. It broomed the heads of the piles, shook and weakened the engine, took too much time in its movements, and shattered and split with its own weight; though composed of the best *live oak*. The rams

which he had himself constructed. The building committee where thus left to struggle through every difficulty, unaided by any person practically acquainted with such work; and with no scientific assistants. They depended solely on the workmen, who had gained some experience at the eastern dam, for the farther execution and fortunate completion of the work; which they faithfully performed. It is not surprising that the committee should, after all other schemes were considered, and found fallacious and impracticable, be fully sensible of the risque and difficulty of attempting a new and untried undertaking. In their report of the 31st December 1802 they thus express themselves.

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used at the piling of the foundations of the western abutment and wings, were less; being of about 500 pounds. They moved quickly, did more work, and required less power to move them; but the piles were smaller.

The *machinery* of the engine at the dam, was moved in the usual way, seen in large horse mills, by four horses, on a floating stage, anchored near the dam. There were several parts, ingeniously, and uncommonly, contrived. The ram was elevated by a 6 or 7 inch rope, which was *white;* because tared yarn was found more inflammable, and otherwise unfit. The friction (though the sheave, over which it moved, was of 18 inches diameter) was so great, as to excite a heat, which consumed the hemp internally, when the surface appeared sound, and felt cool: so that the best rope soon failed; and *chains*, never so neatly formed, would not answer. The ram could be drove to 60 strokes in an hour; but 40, were found as many as were, with prudence, admissible. The rope was worked by a vertical *cyllinder;* on the principle of the *capstan* and *leading block*. This cyllinder was thrown out of gear, by a simple operation, produced by the weight of the ram ceasing to act on it, when detached from the traveller. It then (being operated upon by the weight of the traveller) performed a retrogade motion, so as rapidly to unwind the rope; and the traveller instantly followed the ram, in its descent. As soon as the tongs had seized on the ram, the cyllinder was again in its place, and progressed in its duty. The horses, relieved when fatigued, constantly proceeded, with a steady, but somewhat quick pace.

"Our particular duty, as a committee, was to superintend the execution of the plan. But as members of the board, we cannot avoid lamenting that the dangerous character, of the river, its extraordinary depth and rocky bottom, forbad any other mode, to ensure the stability of the piers, than that which necessity compelled us to take. Every substitute we could devise, or were informed of, even though some were only plausible, or palpably visionary, were stated to Mr. *Weston*, than whom there are few, if any, among hydraulic engineers more competent to judge. He decidedly advised us to the mode we have adopted; warning us of the difficulties we had to encounter. He disinterestedly gave instructions, and furnished the plan of the *coffer dam*, which is a pattern worthy the imitation of all who engage in such enterprizes. After experiencing the expence and difficulties in erecting our eastern pier, we had no small apprehensions in undertaking the present work. We were *flattered* by our success; and our experience was in no small degree, essentially useful. But we foresaw additional danger and expence in our present object. We even wished, if an iron or wooden superstructure were intended, to propose avoiding the sinking the present dam and erecting this pier, by adopting an extended arch, comprehending the breadth of the river, which in theory, seemed practicable. We know that no *iron superstructure* of such a span had been executed. We sent for Mr. *Timothy Palmer*, of *Newbury Port*, a celebrated practical wooden bridge architect. He viewed our site and gave us an excellent plan of a *wooden superstructure*. But he pointedly reprobated the idea, of even a wooden arch extending farther than between the position of our intended piers, to wit, 187 feet. He had at the *Piscataway* bridge, erected an arch of 244 feet; but he repeatedly declared that, whatever might be suggested by theorists, he would not advise, nor would he ever again attempt extending an arch, even to our distance, where such heavy transportation was constantly proceeding.

We therefore found ourselves compelled to progress, on the plan we have been executing; let the expence or difficulty be never so discouraging. Happily we have thus far succeeded; but it is with some emotion, we look back at the dangers we have escaped."

By a report of December 26th 1803, it appears that (although the work was not then finished,) "The whole of the stone work from its commencement consisted of 105,780 feet of cut and hammered stone, included in 15,131 perches of masonry. When it is considered that *one half, at least, of this was erected under water*, it is not extraordinary that the work should have been tedious, difficult and expensive."

The cut stone was very expensive; though an expedient of cutting the faces of those *under water* only at the joints, about two inches broad, was suggested to, and adopted by the mason.

The eastern pier is 40 feet high from the foundation, and contains 3635 perches of masonry.

The western pier is 55 feet 9 inches high from the foundation, and contains 6178 perches of masonry.

Seeing, then, that such difficulties and unavoidable expenditures attend bridges erected *on piers*, especially where *batterdeaus*, or *coffer dams* are used, it is to be regretted that the genius of hydraulic engineers and architects, or others, whose minds have been occupied in such subjects, has not, in a long course of time both enlightened and active, produced some *practical specimens* of single arches, of such span as to supersede the use of *piers*; in deep and navigable streams, at least. This not having been done, sufficiently proves, that (however plausible the theory) the practice has not, though indubitably desirable, been thought safe or justifiable. There have been sundry plans proposed; but none accom-

plished on an extensive scale. Every projector of such arches or inventions, has an *exclusive confidence* in his own project; and some of them pronounce philippics and denunciations, against *bridges on piers*. The expence and difficulties attending these, are too well known, to be disputed; or to require display and enumeration. But actual experience, from the most remote times to this day, has warranted their being employed; preferably to untried, however ingenious schemes. The advantages of single arches, for navigable streams particularly, *are obvious*; and experiments, on any feasible plan, are *devoutly to be wished*. It is easier, in many cases to vault over, than to encounter, difficulties and dangers. But the question is, who can afford it, or will take the risque of the first leap, in an expensive operation. Hitherto no very extensive single arch has been hazarded in practice; unless the one at *Weremouth*, be considered as a decided example. Yet, at the time of erecting the *Schuylkill* bridge, there were great doubts of the stability of the *Weremouth* arch, suggested by a respectable English Engineer, who went *expressly* to view it. Insomuch that the inventor, and executor of that work, who was conversed with, pointed out defects; and it appeared had changed and improved his plans, in after erections. It would have been unjustifiable, in those who had the trust of other persons money, to put it at the risque on a theory, however plausible. When engaged in a plan, dictated by experience and former practice, they were *compelled to hazard, by necessity*, in the progress; and *justified by success*, in the event.

Those who wish to indulge their curiosity, and exercise their patience on such subjects, may have the opportunity afforded, by the perusal of the voluminous

reports of the "*Select Committee*" of the British Parliament, "*upon the improvement of the Port of London*" printed in 1801.—The advantages and disadvantages, and the theory and practice of arches, single and multiplied—the strength, application and quality of materials —the uses and inconveniencies of piers—and all points relating to a project for erecting the single arch before mentioned, over the *Thames*, will there be found, learnedly and ably discussed, by men of the first talents, both professional and theoretical, in *Great Britain.*

In one of the reports there are two elevations of bridges—one with a single arch of iron, 600 *feet span*, calculated for vessels "*to pass under it*"—the other of a stone bridge, of 9 arches, *on piers*, with an ingenious plan of a *draw*, designed to exemplify a "mode of admitting *ships to pass through it*, at all times; without occasioning any interuption to the land communication over it." The relative and positive merits of these and other projects, are elaborately and scientifically discussed and examined, in this, and several precedent reports.

CHRONOMETRICAL OBELISK.

To complete the usefulness of this work, a *pyramidical Pedestal*, surmounted with four *Dials*, for the benefit of passengers, is erected at the eastern entrance of the bridge; and on three of the *Tablets*, the most prominent facts and events, occurring in the construction, are recorded. This small *Obelisk* (fifteen feet eight inches in height from the foundation, and five feet square at its *Plinth*) is of *white marble*, on a basement of *freestone*, and is of neat and simple construction, in character with the masonry of the bridge. The inscriptions appear to be composed in conformity with a correct criticism on such subjects, as expressed by the elegant pen of the late Dr. *J. Beattie*. They are calculated "*to convey to the traveller, not the wit of the composer, but some authentic information in regard to the object that draws his attention, and is supposed to raise his curiosity.*"—"*They are simple and true; and as concise as the subject will admit.*" In imitation of the *Greek* and *Roman* inscriptions "*mixtures of verse and prose*" of "*foreign languages*," and of narrations too much encumbered with abstract remarks,--have been avoided.

There will be also an *Equation Table*, to shew the difference between the time marked by the *apparent*, and that measured by the *real*, motion of the sun. With the aid of these accurate and curious *Dials*, and the Table; which were delineated, with scientific precision, by Professor *Patterson*, a complete *Chronometer* is obtained. The same gentleman also obligingly furnished, from careful observations, inscriptions of the *latitude* and *longitude*, and *the variation of the compass*.

These objects have been long desired, by astronomical and philosophical characters. Their advantages are obviously great, and highly creditable to the Company; who have thus extended the public utility of this establishment.

With copies of these inscriptions, taken from the Tablets, and the list of *tolls* established by law, this account will close. The statements and remarks have been made with no other views, than to excite others to constancy in necessary undertakings, under circumstances appearing never so difficult and forbidding. If scientific or practical knowledge be wanting; it is proved, that persistance, with even common talents, can effect the most valuable purposes. Nor is it intended to hold up this work, as one singularly pre-eminent over all others; or vainly to display peculiar personal merit; though in some of its parts it was attended with unexampled difficulties; which were overcome by unremitted exertions. If this communication should convey any useful instructions, or excite to similar perseverance, its end will be attained. If it should invite others, to give publicity to their ideas on such subjects; and to impart similar information, of the *improvements* made in various parts of this prosperous country;—rich in the spirit, industry and enterprize of its citizens,—no small reward will be obtained, for the time and pains bestowed.

WESTERN TABLET.

THIS BRIDGE
was erected
at an expence of
near 300.000 Dollars,
by a *Company*
Incorporated the 27th of April,
in Virtue of a Law,
passed the 16th of March
1798.
The Coffer Dams,
Foundations,
and other subaqueous works,
consumed a great proportion
of the Expenditures.
It was commenced,
by laying the first stone of the
EASTERN PIER,
after many difficulties had
attended the Dam,
on September the 5th,
1801.
And completed for passage, January 1st,
1805.
The Cover was begun and finished,
In the same year.

SOUTHERN TABLET.

Dimensions
of the
BRIDGE.
Length 550 feet.
Abutments
and wings 750
Total—1300.
Span of smaller arches each 150.
of middle arch, 194 feet 10 inches
Width of the Bridge—42.
Curvature of the middle arch, 12.
of the smaller arches 10.
The *Curves* are *Catenarian.*
Rise
of the Carriage way—8 feet.
Height,
over the platform, to the
Cross ties—13.
From the surface of the
River to the platform,
in the greatest elevation, 31.
Elevated
above all Floods
ever known
In this River.
Inclined Plane to Entrances; 3 1-2 Degrees.

NORTHERN TABLET.

THE EASTERN PIER
was first erected; in a
depth of water of 21 to
24 feet, in a *Coffer Dam.*
The lower course of
Masonry is bolted on the
Rock.
THE WESTERN PIER,
attended with greater dif-
ficulties, constant hazard and
unavoidable expense, was
commenced in the midst of
an inclement Winter, within
a *Coffer Dam*, of original and
appropriate construction;
in which 800.000 Feet of
Timber were employed.
The depth of Water from the
Rock is 41 Feet.
No Pier of *regular Masonry*,
in so great a depth of Water, is
known to exist in any other part
of the *World.*
The Masonry of this Pier, was
begun on Christmas Day 1802:
And erected from the Rock to
low Water Mark, in 41 Days and
Nights; after 7 Months had been
occupied in preparing the Dam,
and retrieving its Misfortunes.
These Piers are in *Length* 71 Feet 6 Inches,
and in *Thickness* 30 feet at the
bottom; battering to the top; where
they are in *Length* 60 Feet 10 Inches; and in
Thickness 19 Feet 4 Inches.
The Height of the *Eastern Pier* from
the Rock is 40 Feet; and that of the
Western Pier is 55 Feet 9 Inches. The first contains
3635 Perches, and the latter 6178
Perches of *Masonry.*
The *Eastern abutment*, 18 Feet thick, and
its wings, are founded on the Rock. The *West-
ern abutment*, of equal Thickness, and its wings,
are built on a platform supported by Piles.
Splay of the wings, 60 Feet.

EASTERN TABLET.

THE BRIDGE
is *in itself*,
the most grateful
Reward,
expected from its
Institution:—
A *Recompense*,
the most honourable to those,
who by liberal advances,
and long Privations of Profit,
unassisted by public pecuniary aid,
Encouraged and Supported:—
And a *Memorial*,
the most acceptable to those,
who by enterprising, arduous,
and persevering exertions,
ACHIEVED,
This extensively beneficial
Improvement.

Rates of Toll, according to Law, at the Schuylkill Permanent Bridge.

For every

	Cents.
1. Foot Passenger,	1
2. Horse or Mule, without Rider or Harness, *(Halter excepted,)*	1
3. *The same*, with Rider,	2
4. Head of horned Cattle, not more than 20 to pass at one time,	1
5. Living Sheep, Swine, or Calf,	½
Carriages of Pleasure.	
6. Four wheels, drawn by four horses,	20
Additional Horse, each,	4
7. *The same*, drawn by two horses,	12
8. *The same*, drawn by one horse,	10
9. Two wheels or Sleigh, with two horses,	10
Additional horse,	4
10. *The same*, with one horse,	6
Carriages of Burden.	
11. Four wheels drawn by four horses, loaded,	17
Additional horse, each	4
Add, to the additional horses,	
If 3 tons, or above 2 tons,	5
4 tons, or above 3	15
5 tons, or above 4	45
6 tons, or above 5, being the heaviest weight allowed to pass,	135
12. *The same*, with produce of the country, wood and stone excepted,	12½

	Cents.
Additional horse, each - - - -	3
13. *The same*, with manure or empty - - -	8½
Additional horse, - - - - - -	2
14. Four wheels, drawn by three horses, loaded, -	14
15. *The same*, with produce, except wood and stone,	10½
16. *The same*, with manure or empty, - -	7
17. Four wheels, drawn by two horses, loaded, -	12
18. *The same*, with produce, except, &c. - -	9
19. *The same*, with manure or empty, - - -	6
20. Two wheels or sled, drawn by two horses, loaded,	10
Additional horse, each - - - - -	4
21. *The same*, with produce, except, &c. - -	7½
Additional horse, - - - - - -	3
22. *The same*, with manure or empty, - - -	5
Additional horse, - - - - - -	2
23. Two wheels, or sled, drawn by one horse, loaded,	6
24. *The same*, with produce, except, &c. - -	4½
25. *The same*, with manure or empty, - -	3

26. Oxen in draught; 2 estimated as equal to 1 horse. Sleds of heavy burden, to be estimated as four wheel carriages of like burden.

RULES, ACCORDING TO LAW.

Persons, carriages, or cattle, of whatsoever description, *passing over the Bridge* will keep to the right. Offence against this Rule, by obstructing the Passage, will subject the *Drivers of Carriages to back out*, and *Drivers of Cattle to return*, and enter on the proper direction, under penalty of thirty dollars.

Carriages of heavy burden shall pay as loaded, which contain any thing more than feed for two days journey.

Carriages of light burden shall pay as loaded, if not wholly empty.

Loading, if not wholly produce, is not entitled to diminution of toll. Loads of any description whatsoever, exceeding two ton, their weight shall be truly declared by the driver, previous to passing.

Injury done to any part whatsoever, of the property of the Bridge Company, will subject the offender to forfeiture and payment of thirty dollars, and of being liable to damages for further torts. Evasion of tolls is injury of property.

Published by order of the Board of Directors.

J. DORSEY, Treasurer.

Philadelphia, December 31, 1804.

ERRATA.

Minor errors, both of *Orthography*, *Grammar*, and *Punctuation*, are left to the reader to correct.

In page 7, after "Mayor and Commonalty" insert "*and their successors.*"

In page 56, "6 per cent discount" should be, "6 per cent dividend"

INDEX.

A

B

C

C

☞ *Tarred rags*, or pieces of shingles *tarred*, suspended on the limbs of fruit trees, have been found effectual to expel the *curculiones;* as they dislike the scent of *tar*. Probably *tarring* the stocks of *apple trees*, near the ground, would keep off the *cerambix*, or other insect or worm so destructive to them.

D

D

E

F

F

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H

H

I & J

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M

N

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O

P

P

R

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S

T

V

W

W

Y

Z

ERRATA.

Premiums,	Page xxxix,	line	2, *after* cover *read* will
Memoirs,	17,		12, *for* wilderness *read* wildness.
	31,		13, *for* had *read* has.
	32,		31, for *System* read *Systeme*.
	36,		11, *for* less destructive *read* more destructive.
	104,		10, *for* patched *read* packed.
	105,		31, *for* perviousness *read* imperviousness.
	146,		20, *for* disease *read* diseases.
	156,		24, *for* opinion *read* opinions.
	159,		18, for *Alatamaha* read *Alabamo*.
	164,		31, *for* comprising *read* comprised in.
	195,		6, for *country-* read *connty-*.
	200,		10, *for* goal *read* gaol.
	208,		32, *for* build *read* built.
	215,		2, *after* weeks *read* after the first dressing.
	228,		2, *after* is contained *read* in due proportions.
	245,		22, *for* bucking *read* backing.
	308,		34, *after* have *read* been.
	321,		4, *for* gauge *read* gouge.
Selections,	20,		23, *after* indian corn *read* is not uncommon,.

Errors neglected to be noticed, are left for correction, to the candour of intelligent readers.