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INSTITUTED MDCCCXXVIII

THE ROYAL CORNWALL

POLYTECHNIC SOCIETY.

ESTABLISHED A.D. 1833.

THE TWENTY-SIXTH

ANNUAL REPORT.

1858.

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ANNUAL GENERAL MEETING.

The Twenty-sixth Annual Meeting of the Royal Cornwall Polytechnic Society was held in the usual place on Monday, January 17th, 1859.

The Chair having been taken by the President, Sir C. Lemon, Bart., the Secretary proceeded to read the Report of the Committee and the Treasurer's Report, and the following resolutions were passed:—

Resolved:—That the Report of the Committee and the Treasurer's Report be adopted and printed.

Resolved:—That the List of Prizes and Premiums as amended for the year 1859 be adopted.

Resolved:—That the following gentlemen be elected Vice-presidents in the place of those retiring:—John St. Aubyn, Esq., M.P.; John Michael Williams, Esq.; Alfred Fox, Esq.; and J. Baxendale, Esq.

Resolved:—That the Committee be re-elected, and that the following names be added to the list:—Hender Rogers, Esq.; Withers Williams, Esq.; Rev. R. F. B. Rickards, Falmouth District; Rt. Hon. Viscount Falmouth, Truro District; J. J. Rogers, Esq.; Rev. A. Jessop, Helston District; J. F. Bassett, Esq., Redruth District.

The following votes of thanks were then passed unanimously:—

To Mr. S. Gurney, M.P., Mr. Jacob Bell, Mrs. Giles Schwabe, Mr. Gilbert Chillcott, Mr. T. H. Tilly, Mr. E. B. Tweedy, Mr. J. Freeman, Dr. Drake, Rev. F. G. Gutteres, Mr. C. Rule, Mrs. Griffin, Mr. Swatman, Miss Fenwick, Major Boulderson, Mr. W. Carne, and other members and friends of the Society, who kindly lent specimens of Fine Arts, Curiosities, &c., for the last Exhibition.

To those ladies and gentlemen who so efficiently acted as Judges at the last Exhibition.

To those gentlemen who have kindly made Presents or Donations to the Society during the past year.

To those Institutions which have kindly presented Books and Papers of their proceedings to the Society.

Resolved:—That the Polytechnic Hall be let to some responsible person for the present year, reserving the use of it for the purposes of the Society, for the County Court, for the Misericordia, and other Societies which have hitherto had the use on reduced terms.

Resolved:—That Mr. E. B. Tweedy, Mr. W. Carne, Mr. J. Freeman, Mr. J. Bennetts, and the Secretary be appointed as a Sub-committee to arrange the terms upon which the Hall should be let.

Resolved:—That the Resolution passed on the 12th of January, on the subject of the Education of Miners, be forwarded to Dr. Barham, in answer to his letter.

After some discussion on the subject of Engine Reporting, it was—

Resolved:—That as Mr. Lean's form of Report is approved of by the Society, and as the appointment of one Reporter is the most likely mode of securing uniformity in the Reports, it is hoped that the system of Reporting Engines will be generally adopted in the mines of Cornwall and Devon.*

Resolved:—That the thanks of the meeting be given to Sir Charles Lemon for his efficient conduct in the chair.

* This resolution was passed under the misapprehension that Mr. Brown had ceased Reporting; but as he claims the credit of originating certain headings in the form of Report, the Society do not see that they can take any further steps until the two Reporters come to some mutual arrangement.

PRESENTS TO THE SOCIETY DURING 1858.

American Journal of Science. From the Editors.
Journal of the Franklin Institute, U.S. From the Institution.
Quarterly Journal of the Chemical Society. From the Society.
The Artizan. From the Editor.
The Vegetarian Messenger. From the Publisher.
Twenty-ninth Annual Report of the Royal Institution of Cornwall. From the Institution.
Proceedings of the Literary and Philosophical Society of Liverpool.
Memoirs of the Literary and Philosophical Society of Manchester.
Actinologia Britannica. From the Author.
Report of the Plymouth Institution. From the Institution.
Journal of the Dublin Society.
Proceedings of the Royal Institution.
Report of the Free Library, Liverpool.
Bust of the late J. Trevithick, Esq. Presented by his family.

REPORT OF THE COMMITTEE.

In presenting their Twenty-sixth Annual Report of the progress of the Society, your committee would first revert with especial gratification to the general increase of interest which appears to have been felt in the welfare of the Society during the past year, especially during the Annual Exhibition.

The first and most important proof of this increased interest is in the fact that the receipts for admission to the exhibition have been greater this year than on any previous occasion, and the pleasure and instruction afforded to visitors exceeded anything that has been experienced for some time past.

The great number of objects of deep interest forwarded this year, both for exhibition and competition, especially the superiority in numbers and usefulness of the objects in the Mechanical department, more than ever convinces your committee of the vast capabilities of the Society for the encouragement of industry and talent; and although upwards of £90 has been expended this year in prizes alone, exceeding by £27 the sum expended last year, the committee still feel that if the county responded more generally to their endeavours, and if a still larger sum could be collected from subscribers annually, their sources of usefulness might be vastly increased. At present, however liberally disposed the judges may feel, it is impossible to reward in an adequate manner the whole of the deserving competitors who contribute; thereby, in some instances which are much to be regretted, giving rise to the impression that the Polytechnic is indifferent to their claims, or does not fully appreciate the value of their inventions.

It has been a source of great gratification that this year many prizes have been awarded in cases where the recipient has had no other means of making his inventions known, and might otherwise have remained long in obscurity; in other instances they have rewarded ingenious men, who have suffered from continuous disappointment and neglect; in others they have conferred assistance on struggling artizans with such slender means of support, that a prize even of a few shillings has been a stimulant and encouragement to them; and in all it is to be hoped they have proved their strong desire to assist and encourage talent of every kind as far as their means will allow.

Another satisfactory result of the last year's exhibition has been the new rule which enables the judges to award medals to patented articles. Few things could have tended more to extend the influence of the society than this. Several very useful inventions have been forwarded from many distant places, even as far as Glasgow, and the expressions of satisfaction at the award of the society's medal have been very gratifying. It has been the means of inducing more persons at a distance to become members, and exhibit a lively interest in the welfare of the society. In many instances the medal has been much more highly valued than a large award in money would have been; and although undoubtedly the greater portion of the funds at the society's disposal should be devoted to the encouragement of scientific and artistic productions in our own county, it could very well afford to bestow annually a certain number of medals on deserving inventors at a distance, thereby conferring great benefits on others, and both directly and indirectly benefitting itself in return. There is no reason why the direct advantages of the Polytechnic might not in this way be extended to the whole of England, which would probably bring such an amount of interesting objects to our exhibition every year as would draw a still larger mass of people together, and well repay any slight extra trouble and expense which might be involved.

Another comparatively new feature to which your committee would direct your attention is the result of the evening exhibitions. Although disappointed in many supporters of the society, who, it was hoped, would have favoured us with lectures on the occasion, the attendance during the evenings was very numerous, and the evident enjoyment derived by those present from an inspection of the works of art and science collected in the Hall could not be doubted.

In reverting to the exhibition itself, your committee would first mention the obligation they are under to Mr. W. Smith, the talented editor of the "Artizan," for the kind assistance he has rendered on this and many previous occasions. This year, especially, many important and valuable inventions by Professor Wheatstone and others were forwarded, together with some ingenious scientific contrivances for demonstrating certain philosophical facts, which afforded continued instruction and amusement. To Messrs. W. and J. Freeman also your thanks are due for the fine obelisk and specimens of polished granite which ornamented the Hall, and to the agents and captains of mines, as well as the miners themselves, you are indebted for many interesting novelties in mining operations which, it is to be hoped, will prove of general usefulness to that most important branch of the industry of the county.

For the chief object of interest in the Fine Arts department, and indeed, considering its world-wide renown and great intrinsic value, the most prominent feature of the exhibition, Dubuffe's celebrated portrait of Rosa Bonheur, you are indebted to the kindness of the respected member for Falmouth, Mr. Samuel Gurney, who most readily responded to our desire by sending this great attraction to our exhibition. The picture, placed in a prominent position at the end of the Hall, together with two others of equal beauty and value in their way, contributed, with a generous liberality which cannot be too highly appreciated, by Mrs. Giles Schwabe of Manchester, formed a group which, from its extreme beauty and almost inestimable value, might have drawn together thousands even in the metropolis, and which was an attraction almost unprecedented in this comparatively remote locality. No less are your thanks due to Mr Jacob Bell, of Langham place, for the loan of three pictures perfectly unique in there way, being early productions of that renowned painter Sir Edwin Landseer; and also for other pictures from Mr. Bell's well known valuable collection, including a very fine specimen of "Lee and Cooper." For the further loan of pictures and curiosities, your thanks are also due to Mr. T. H. Tilly, Mr. E. B. Tweedy, Mr. J. Freeman, Dr. Drake, the Rev. F. E. Gutteris, Mr. C. Rule, Mrs. Griffin, Mr. Swatman, Miss Fenwick, Major Boulderson, Mr. Carne, and others, who appear to have evinced a general desire on this occasion to render the exhibition as agreeable and attractive as possible. It is gratifying also to find that some London artists of eminence have again forwarded their works for exhibition, one of which, a Landscape by J. E. Niemann, was a marvellously powerful production. If greater encouragement could be held out to those who take the trouble to send from so great a distance, by the purchase of some of their works by those visitors whose means would enable them to do so, we might hope for an annual exhibition, whose attractions might materially increase the revenue of the society, and afford recreation and instruction to all lovers of the fine arts in the locality.

The chief feature of the Naval Architectnre department was a collection of models by Mr. Trescowthick, of Par Pier, who has for some years devoted many hours before and after the more onerous duties of the day to the construction of models in connection with marine architecture, which display no common amount of invention and ingenuity, to which it was thought right to award a second silver medal. Mr. Geach also obtained a medal for the model of his new mode of propelling vessels; the chief feature of which appears to be the facility with which they may be moved sideways, as well as backwards and forwards. This invention, if successful when tested on a larger scale, will probably effect a considerable revolution in our system of navigation.

The Natural History department was also again abundantly supplied, especially by the more juvenile votaries of this delightful study, who have evinced an amount of diligence and perseverance in this pursuit, which is most satisfactory. To this, and to some other departments, some valuable Papers have this year been contributed, among them a continuation of Mr. R. Q. Couch's investigation of the mortality of miners, which when complete will prove a most useful document on this question of literally vital importance.

It is again the painful duty of your committee to record the demise of several old and valued friends of the society, amongst whom are Mr. Joseph Carne, Mr. Michael Williams, and Mr. J. Vigurs. These have been added to the number of those who since the commencement of the society have been removed from amongst us. As the results of the past year have proved that the interest felt in the society is by no means on the decline, your committee would express a sincere hope that those younger members who are year after year filling the places of those who have gone before, will exercise the same activity and zeal as their predecessors in the furtherance of its great objects, and all endeavour collectively and individually to advance its means of usefulness.

With regard to the finances, the large amount paid in prizes this year precluded the possibility of setting aside any further sum towards the reduction of the loan on the building. The balance now in the banker's hands is £28 : 15 : 10, which, together with certain subscriptions which have been applied for but not yet paid, should be reserved for certain accounts which have not been received in time for insertion in the balance sheet. Up to the end of the year, the receipts were £412 : 10 : 5, and the disbursements £383 : 14 : 7.

THE ANNUAL EXHIBITION.

The Twenty-sixth Annual Exhibition of the society was opened at the Polytechnic Hall, Falmouth, on Wednesday, September 30th, and was of such a character as to prove highly gratifying to its promoters as it was creditable to the county. Established in 1832, twenty-six years ago, the society has endeavoured since that period to promote the great objects which its founders had in view; viz., the advancement of scientific knowledge, the encouragement of mechanical invention, and the promotion of a pure taste in, and, as a consequence, a greater love for, art, by means of annual exhibitions and the offer of prizes for mechanical inventions, particularly such as were applicable to mining operations, and for fine art productions. Unfortunately, however, the study of mechanics has not proved so engaging as that of its more attractive sister art, and the result has been that during several years the mechanical department has gradually fallen off in extent and value, while, with increasing years, the fine art department appeared to increase in importance. On the present occasion, however, a gratifying improvement in this order of things was evident, for not only was the exhibition excellent as regards works of art, but in the number and importance of the new mechanical inventions and improvements, the extent of the collection of the models of naval architecture, and the value of the other departments, it was allowed by the judges and visitors to be far superior to any exhibition of the society for some years.

On entering the Hall, the view was at once striking and gratifying. A large fountain, erected by Mr. J. H. Bullock, the basin of which was tastefully surrounded by ferns and moss, occupied the centre of the room, and continued to play throughout the day, producing a most agreeable coolness during the most crowded periods. Around the ends and sides of the room were displayed the collections forming the scientific and industrial portions of the exhibition, and including besides those we have mentioned, a great variety of interesting objects in natural history, ladies' work, &c. Above these, over the whole of the remaining space of the walls of the Hall, were ranged the pictures contributed to the exhibition by private gentlemen of the county, professional artists, and the productions of the pupils attending the Truro and Redruth Schools of Art, and other public and private schools in the county. And here we have another gratifying feature in the exhibition to notice. Not only were the number and character of the pictures by professional artists equal to any previous exhibition held for some years, but those by amateurs,—a part of the exhibition which last year was greatly deficient,—were greater in number and superior in point of merit to what had ever before been contributed by this class.

In the Mechanical department the most important models were sent by exhibitors belonging to the county, and were intended to facilitate the operations in that branch of enterprise and industry in which the inhabitants are most deeply interested; viz., mining. Messrs. R. Hosking, jun., R. Liddycoat, jun., and A. Thomas, of Bassett Foundry, Devoran, exhibited an improved pump-valve, and they stated that their object was to bring to notice the great benefit to be derived by the Cornish mines in general from the use of vulcanised India rubber for the beats of pump-valves instead of leather. The advantages were described by the inventors as follows:—"1st. It is impervious to moisture, not only from water, but also acids to a great degree; neither has heat any effect upon it, up to a high temperature: therefore water, however hot or corrosive, cannot injure it; and in consequence it has been for years in extensive use for air-pump valves, not only in marine engines where it is subject to the utmost wear and tear, but in numbers of land engines in our manufacturing districts. 2nd. No waste of material is incurred in preparing the gearing (as is the case to a very great extent where leather is used for that purpose), the India rubber being manufactured to any given size or shape that may be required. 3rd. The elasticity of vulcanised India rubber is irresistible; the beats constructed of this material are cushions, consequently concussion otherwise produced, in this case is considerably reduced." And they add that many other advantages might be enumerated, but the great benefit to be derived consists in its durability in hot mineral water.

Perhaps, however, the most important invention as regards mining, was exhibited by Captain Skewes, of the Wheal Seton mine. It consisted of the model of an improved process for dressing ores from the shaft's mouth. It was stated that this machine was erected at Wheal Seton mine twelve months ago, where it has been in operation ever since with decided advantage. The advantages of the process are the complete separation of the ores into four different sizes, thus doing away with the expense of riddling, the fine being sufficiently small to be taken to the jigging-hutches without further reduction. A spout of water is employed to wash the dirt from the larger stones, so as to exhibit their qualities. The waggon traverses a railway over the slides, and is tipped by the lander without going round the waggon to take out the tail-pin. The judges expressed a very high opinion of the value of this invention. Mr. H. Sims, of Scorrier House, exhibited a patented valve for the pit-work of mines. The peculiarity in this valve, and for which the inventor has taken out a patent, consists in the adoption of a wood and leather "beat." Mr. John Michell, blacksmith, Ford's Row, Redruth, exhibited an improved assay mould. Mr. Michell stated that whilst on the present system several bolts were required of different concavities to accomplish their samples, in his improvement one frame would do for any number of pits by removing the little bolt, and putting in those most suitable for making the regulus; then change for refining, so that eight or ten of these pits would be of no more expense than two ordinary bolts, besides so much lumber would be done away with. If at any time the bolts should "stick," as it is technically termed, it could be easily turned in a small lathe; while the old sort could not be done without much difficulty.

An improved stamping machine was exhibited by Mr. John Adams, of North Roskear mine, which promises to be of considerable value. The improvement consists in the stamps being lifted from the centre instead of the outside, as in the old method, thereby affording greater leverage.

Mr. Wilton, of St. Day, exhibited an admirably constructed miners' theodolite. In this the assistants' tripods are placed at exactly equal elevations, which enables them to move from one to the other alternately without affecting the level.—A model of an improved instrument for tin dressing, especially as affects the cost, was exhibited by Capt. R. Pearce, of Dolcoath mine. The chief objects intended to be accomplished by the machine is the concentration of the dressing within narrower limits, so that the operation may be more fully under the eye of the captain, to economise labour, and consequently the cost of dressing. Mr. William Polkinghorne, Gwennap, exhibited an exhausting fan for the ventilation of mines, but there was nothing about it deserving of especial notice.—William Verran, engineer at Messrs. Freeman's, Penryn, exhibited a fine model of a steam engine with new side valve, which was fixed on a granite bed; and James Williams, a working miner at Redruth, also exhibited another model of a similar engine, although he saw a steam engine for the first time only two years ago.—Messrs. Hamilton and Co., of Glasgow, exhibited models of Silver's patent nautical regulator and four-ball steam governor; by the adoption of which, in a steam vessel, a uniform action of the engine would be secured and maintained—that she could never race when the resistance was taken off, and would always have her power ready when required, which must necessarily add to the comfort, speed, and security of the passage.

Amongst the other objects of curiosity, were models of Wheatstone's Dynamometer, which is similar to the machine employed in paying out the Atlantic cable; Wheatstone's Pseudoscope, which has the peculiar effect of causing convex objects to appear concave and the reverse; Wheatstone's Gyroscope; a new patent self-acting broach-lock, by J. Long, Tiverton; a machine for clothing copper wire for electrical purposes, by Alfred Jeffreys, St. Day; and as a proof of the advantage of this process, the inventor states that copper wire, covered by the old process, which cost 4*s*. per lb., under his process would only cost half the sum, and it can be covered at the rate of a pound per hour by the machine; an improved sowing machine, from Messrs. Thomas and Co.'s, Newgate Street, London; a model of a harrow bridle, by N. Sibly, Bodmin; a turnip cutter on an improved principle, and a cooking apparatus, by S. Terrill, Redruth; Howarth's Victoria varnish, by Mr. J. D. Freeman; a pedal safety-cot, invented by Mr. C. E. Bull; Fox's improved dipping needle, exhibited by Mr. M. Olive, Falmouth; to which Mr. Fox. had caused to be applied an aluminium pully for magnetic intensity experiments, also an ivory pulley which answered satisfactory; neither of these having been so used before. The instrument was also made suitable for ascertaining the absolute terrestrial or total force; single and double action steam engines, by Mr. W. G. Geach, Falmouth; a shooting-boot, by James Bamfield, Helston; an improved drill for boring, by Mr. Sara, Penryn Foundry; an improved throttle valve, and one or two other improvements, were exhibited by Mr. W. Bone, Budock; Mr. J. G. Harris, of Falmouth, also exhibited an apparatus for assisting shoemakers in their employment, enabling them, in particular, to stand whilst beating leather. In the way of music there was a violin by W. Old; and a musical scale, with moveable notes, exhibited by Mr. Fitton, being the invention of his sister. Another ingenious invention was a model of a false leg, by Mr Leawood, for persons who happen to have been so unfortunate as to have had that limb amputated above the knee; and the springs of the knees and ancle joints have been so ingeniously constructed that, in walking, the leg imitates the movements of the natural limb in a most extraordinary manner.

In the Fine Art department the contributions comprised numerous pictures of considerable merit: amongst those who kindly lent pictures for exhibition were Mr. Gilbert Chilcott, of Truro (four fine pictures, two of them views on the Cornish coast); Mr. H. A. Sleeman (four ditto by Mr. J. G. Philp, of Falmouth, together with views of the Residency, &c., at Lucknow); Mr. E. W. Williams; Mr. Enys; Mr. C. Rule; Rev. C. W. Carlyon; Mr. E. B. Tweedy; Mr. Brereton Todd (a picture by Caravaggio of "The Entombment"); Mrs. Townsend Passingham (views of Falmouth Harbour, and on the Tamar); Mr. John Freeman (four pictures); Mr. F. Swatman (Rosa Bonheur's "Horse Fair"); Rev. F. E. Gutteres, Photograph of Sebastopol, &c.; Mr. W. Hocking (two pictures, to which the names of Rubens and Sassafarratti were attached in the catalogue); Mr. D. M. Jewell; Rev. C. H. Halcombe; Miss. Kendall, Lostwithiel; Dr. Drake; Mr. Jacob Bell (four pictures by Landseer); Mrs. Schwabe, Manchester (two magnificent pictures, "Mary" and "St. John," by Ary Scheffer); and Mr. S. Gurney sent the celebrated portrait by Dubuffe of "Rosa Bonheur." Two Busts by W. Burnard, of the late eminent engineer A. Trevithick, and W. J. Henwood, Esq., had also been forwarded to the exhibition by the sculptor, but unfortunately, owing to some delay at the wharf, they did not arrive in time.

The artists' contributions were extensive, and of great value. They included four pictures by Mr. W. Williams, Topsham; eleven (including several portraits) by Mr. Sydney Hodges, Falmouth; one by Mr. J. Read; five by Mr. H. T. Anderson; four by Mr. Thos. Hart, Falmouth; six by Mr. J. G. Philp, Falmouth; two by Mr. H. Tidey; and six by Mr. E. J. Niemann. Messrs. Olver and Sons sent six plans of Station-houses for the Cornwall Railway; and Mr. Slade Olver, Falmouth a portfolio of designs, specimens of manufactures in glass, &c., &c.

In the department of oil and water colour drawings by amateurs, the contributions were:—B. Squire, Falmouth; S. Cook, Jun., Plymouth; L. Scott, ditto; Miss Gatley, Truro; R. Lenderyou; C. E. Brittan; R. H. Carter, Truro; Wm. Genn; C. Vivian; Miss E. Dunn, Truro; Miss Hodgkin; J. Knight; Miss M. Tucker; E. W. Williams, Falmouth; Miss G. Lyle, and Miss M. Lyle; Miss Gregor, Trewarthenick; Mr. S. Michell, Exeter; Mr. A. L. Fox, Falmouth. Crayon, pencil, pen-and-ink drawings, &c., were also sent by the Hon. E. G. Mackay; Mr. G. Appleton, St. Keverne; Miss Squire; Miss Scott, Plymouth; Mr. E. J. Hurdon, Camelford; Miss Gatley, Truro; C. E. Brittan, ditto; Miss. E. F. Tuckett, Frenchay; Miss Hocking, Falmouth; Miss

Mansel, ditto; G. Petherick, Carharrack; Mr. Prince, Redruth; Miss Job, Truro; and Mrs. H. Prideaux.

The department of Sculpture and Architecture was not extensive; but amongst the contributions were a very fine obelisk about 10 feet high, in dressed granite, from the granite works of Messrs. Freeman, Paul, near Penzance; and slabs of polished granite from quarries in other districts contributed by the same gentlemen.

The Naval Architecture department was particularly good, both as regards the great number of models exhibited and the valuable character of some of them. It comprised the fine collection of models of floating and land batteries, belonging to Mr. J. Trescowthick, of Par Pier, Fowey, about 30 in number (including a beautiful model of the *Great Eastern* or *Leviathan)* and for which he was awarded a premium of £20 by the authorities of Somerset House. The formation of this collection has occupied Mr. Trescowthick the greater portion of three years. Amongst the other objects, more especially deserving of notice, were fine models of a cutter and schooner, and a steamer fitted with Geach's patent propeller, which were exhibited by Mr. W. G. Geach of Falmouth; the latter model floated in a wooden trough of water, and was an object of considerable curiosity, especially to nautical men. The fan or propelling power, unlike that of the ordinary screw steamer, is placed in the centre of the bottom of the vessel, and consists of three powerful blades revolving horizontally in a cylinder. As these blades are turned in one direction the vessel is propelled forwards; and by reversing them, which can be accomplished by the mere reversal of the engine, she is forced backwards or to one side as may be required. There was also a model of Holman's improved patent rudder, contributed by Mr. J. Husband; a model of a jury rudder, by Mr. J. G. Lawton; models of life boats, by Mr. W. Rowe, Falmouth; of her majesty's yacht *Fairy*, and of a screw steamer on an improved principle, the latter being contributed by R. Hancock, Devonport.

The Natural History department included a number of very interesting cases of British butterflies and moths, contributed by Master W. C. Squire, who is only 13 years of age; a collection of stuffed and skeleton fish, contributed by Mr. Loughrin; a collection of British eggs, contributed by Master Squire and Master C. Phillips, aged 14; four fine cases of English birds, sent by Mr. J. Jennings; a specimen of the *Ornithorynchus paradoxus*, or duck-billed Platypus, a curious inhabitant of Australia, which appears half animal and half bird.

In the miscellaneous department of the exhibition was a very curious inkstand, contributed by the Rev. F. E. Gutteres, the body being formed out of a Russian hand grenade, and the covers or stoppers to the apertures from which the ink is supplied, being composed of three grape shot: it is a novel and ingenious design. A number of Indian and Mexican curiosities, were contributed by Mr. Rule, Miss Griffin, and others. There were also some interesting specimens of fossil wood from Granada, West Indies, which were collected and contributed by Major Fenwick. A collection of coins, both ancient and modern, were exhibited in the centre of the room, and comprising Greek coins of cities and princes, silver and copper; Roman ditto, of emperors and empresses; Anglo-saxon coins, copper and stycæ; English ditto, of kings and queens since the Conquest; Tokens—a variety of the 17th, 18th, and 19th centuries; Medals—a few in silver, bronze, white metal, and brass, all of eminent men and remarkable events; the property of, and contributed by, Mr. Batting, jun., Falmouth. Also, a beautiful collection of foreign butterflies and moths, contributed by Major Boulderson.

The doors were opened to members at eleven o'clock, and the public at twelve o'clock, and in a short time after the latter hour the hall became thronged with a gay and fashionable company.

THE ANNUAL MEETING.

Sir Charles Lemon, Bart., the president of the society, took the chair at one o'clock, and in opening the proceedings, he observed that it would probably be expected of him that he should give them some description of the various portions of the exhibition; but he felt altogether unequal to undertake such a duty, and under these circumstances, his friend Mr. Rogers would do so for him.

model of an improved process of dressing ores at the shaft's mouth, with an improved waggon. It would be at once seen from the model, that as the stuff was drawn from the shaft, it was at once put into the waggon, which traversed some slides, and was then tipped over four sets of bars, until it was so reduced in size as to be fit for the jigging-hutch. If the stuff was sufficiently good to admit of being taken to the pile at once, there was a hand riddle for that purpose, with which it could be immediately riddled. In addition to all this, there was a water-spout, by which means the quality of the ore might be ascertained, and if sufficiently small, it could be at once carried away. This invention would save the expense of riddling, and to some extent the cost of selection, and therefore it was one of those objects that affected their great source of industry—mining. The committee had awarded to the inventor their second silver medal, and 20*s*. for the model. The next object was the model of a steam engine exhibited by James Williams. There was nothing particular in its construction, but the workmanship was very good, and the committee had awarded it 20*s*. Numbers 6 and 7 were specimens of Howarth's cement and varnish for steam joints, and repairing boilers. They appeared to be very good, and had been used with advantage by Messrs. Freeman; but, as the materials of which the articles were made had not been mentioned, the committee had no means of forming an opinion as to their quality. The next article was the model of a steam engine, placed on a polished granite base. It was a very beautiful model, and the base on which it was placed was very ornamental. It was very satisfatory to find that they could get the Cornish granites thus polished at their own doors in every respect as well as was formerly done in London. Number 9 was a model of an improved tin-dressing machine, which had the effect of saving a considerable amount of labour, Captain Pearse, of Dolcoath, stating that in that mine it had effected a saving to the amount of £250 a year in the department of dressing alone. The committee had awarded to the invention the society's silver medal, and 20*s*. for the model. The next article was a patent safety-cot, invented by Mr. C. E. Bull, which could be easily worked by the foot in any part of the room in which it was placed by a person sitting any distance from it, and it was also protected against all risk of being capsized. The committee had awarded it the second bronze medal and £1 : 10*s*. The next article was a turnip-cutter, exhibited by Mr. S. Terrill, of Redruth, but the committee were of opinion that it was not equal to those in use, and that there was an unnecessary amount of power required for the result produced. No. 12 was an outdoor cooking apparatus, exhibited by Mr. S. Terrill, which was very compact and ingenious; and the committee were of opinion that if its cost could be reduced from £8, it might in many instances advantageously take the place of the present ship's caboose. To this, and No. 13, another cooking apparatus, the committee had awarded Mr. Terrill a second bronze medal and 20*s*. The next three articles which he should mention were Silver's patent nautical regulator, Silver's patent four-ball steam governor, and an improved throttle-valve by Mr. William Bone. After a minute description of the three inventions, which would be unintelligible without the aid of models or diagrams, Mr. Tilly spoke of the importance of improvement in the mode of closing valves of marine engines, and said that the committee gave the preference to Mr. Bone's invention, which the latter had stated to answer exceedingly well on trial in America. The committee considered that it was an invention of considerable merit, and had awarded Mr. Bone the society's silver medal. The next object was a model of an improved method of lifting stamps, by Mr. J. Adams. Mr. Tilly explained that the machine would lift and lower the stamps in the direction of their gravity, and so prevent the friction which occurs in ordinary stamps. Mr. Tilly next noticed a pair of cloth boots made by a blind man; and then remarked that No. 18 was one of those beautiful instruments which reflected honour upon their town and on their respected townsman, Mr. R.W. Fox. It was an improved dipping-needle, and the chief peculiarity in its construction was the employment of the new metal aluminium, instead of brass, which considerably reduced the weight. The workmanship was exceedingly beautiful, and the committee had therefore given the society's bronze medal to Mr. M. Olive, the exhibitor. The next article which he should notice was an improved drill for boring, by Mr. Sara. All persons connected with mining were aware that it was a very difficult thing to bore a hole in hard ground; but this was a machine which professed to do that for them without so much manual labour as was now required. It was very ingenious, because it admitted of the borer being applied at any angle, and therefore, the committee had awarded the inventor the second bronze medal. No. 28 was an improved auger-handle by Mr. W. B. Bone, and the committee were quite agreed that this was one of the most natty and useful little articles that they had seen for some time, as it obviated the necessity of having a separate handle for every auger. There was also a small machine for clothing copper wire for electrical purposes. It was the invention of a lad, to whom the committee had given 10s. by way of encouragement. The next article of any interest was a miner's theodolite by Mr. Wilton of St. Day, who was so well known for his valuable instruments, and whose dials had been of such advantage to the mining interest for so many years, that it was almost an act of supererogation to mention his name as that of one who had been eminently serviceable to the county of Cornwall. The committee were so satisfied of the merits of his theodolite that they had awarded him the society's second silver medal. Mr. Tilly next referred to an artificial leg, which was invented and manufactured by Mr. Learwood, of Truro, and Mr. Sydney Hodges exhibited the properties of the leg to the satisfaction of the company. Mr. Tilly characterized it as a very ingenious contrivance, eminently suited to cases of amputation above the knee; and stated that an artificial leg of like construction, manufactured by Mr. Learwood, had been used by a gentleman with great advantage and comfort. The committee had awarded it the second silver medal. Mr. Tilly next referred, in terms of high approval, to a shifting crutch, which might be easily converted into a walking-stick or rest; and concluded as follows:—The last of the series of objects to which I have to call your attention are the beautiful slabs and obelisk of polished granite which have been kindly sent to the exhibition by Messrs. Freeman, the great granite workers.

It is a matter of pride that there are amongst us gentlemen capable of showing that the Cornish production, granite, can be manufactured in the highest state of art without being sent out of the locality where it is raised. These articles are great ornaments to the room, and we hope that they will in many instances take the place of those foreign marbles to which many of us think they are much superior. In conclusion I have to thank you for the attention with which you have listened to my long story.

Prizes.—Method of improved process of separating ores from the shaft's mouth, with improved waggon, Capt. Skewes, second silver medal and 20*s.* for model. Model of a steam-engine, Mr. James Williams, £1. Model of a steam-engine on polished granite, William Verran, £2. Model of improved method of dressing tin, especially as affects cost, Capt. A. Pearse, second silver medal and 20*s.* Pedal safety-cot, rocked by the foot at any distance, leaving the hand free, Mr. C. E. Bull, second bronze medal. Apparatus for out-door cooking, Samuel Terrill, 20*s.* Cooking apparatus, Samuel Terrell, second bronze medal. Patent nautical regulator, 4-ball steam governor, Silver and Co., second silver medal. Improved method of lifting stamps, John Adams, first bronze medal. Cloth boots, Andrew Thomas (blind man), 5*s.* Fox's improved dipping-needle, Michael Olive, first bronze medal. Improved drill for boring, Nicholas Sara, second bronze medal. Clack-valve, Mr. Sims, first bronze medal. Improved throttle-valve, W. Bone, first silver medal. Improved auger-handle, W. Bone, 20*s.* New design for bed foundations, W. Bone, second bronze medal. Machine for clothing copper wire for electrical purposes, Alfred Jeffree, 10*s.* Improved assay-mould, John Michell, prize 5*s.* Blackett's patent inaccessible lock, second bronze medal. Violin, William Owld, prize 10*s.* Artificial leg, Learwood, second silver medal. Shifting crutch, ditto, 20*s.* Observations on the crystalline forms of the native metals, and on the polished surfaces of rocks, Capt. W. Vivian, first bronze medal. Carnsew granite polished slab, Polcanago, do., and polished obelisk and dye, Messrs. Freeman, second silver medal. Miner's theodolite, Mr. Wilton, second silver medal. Self-acting brooch-lock, J. Long, Tiverton, second bronze medal. Apparatus for assisting shoemakers, J. Harris, prize for labour.

FINE ARTS DEPARTMENT.

Mr. J. J. Rogers read the report of the committee in this department, as follows:—The judges in this department cannot refrain from congratulating the society and the county upon the marked improvement in the quality of the productions submitted to them this year, for although there is no competition in four out of eleven subjects for which the premium of £1 each is offered, yet very creditable specimens are exhibited in each of the other subjects; whilst in the higher department of art, sculpture, painting in oil, in colour, crayon, and pencil drawing are represented. Both in oil and water-colour painting it appears that a higher degree of artistic skill is exhibited than in almost any previous year. It is gratifying to observe the influence which recently offered premiums have exercised in the careful study of nature's flora, and of the human figure, good examples of which will be found in No. 665, (a set of six wild flowers in colour, each bordered with outlines of the same flower,) and Nos. 682 and 684, (*Lilium giganticum*, Miss Gregor, and drawing of a bramble, Mr. A. L. Fox, Falmouth,) and in Nos. 726 and 727, (six pencil outlines of a human hand, and six ditto flowers from nature, by Miss Squire,) which are in outline only—and being the productions of a person of 17 years of age, give promise, by the care and expression which mark them, of still more excellent drawing at a future time. And here it is due to the schools of design to notice that much of this improved development of artistic talent is traceable to the influence which their example has exercised; because not only are numerous specimens of the work of scholars in those schools exhibited this year, but the spirit of their models has been all reflected in many drawings of amateurs not connected with the schools of design. The judges in the department of school productions are much pleased by the way in which their challenge has been responded to, in the careful studies of the details of nature which have been sent in, the clear outline from leaves and flowers, and some coloured and pencil groups. No. 215 (Mr. Anderson's pupils) is a beautiful instance of flower painting. Nos. 242, 3, and 4 (the same) are also admirable specimens, to which the judges gladly award the premium. They have also given a premium of £1 to some capital outlines from natural objects. The more general school sketches from nature are not so good as usual. It is hoped that the prizes awarded to some of the pupils of the schools of design will encourage still further exhibitions from the same quarter in future years, so that benefit may be derived from their continuing to accustom the eye to bold and graceful form, and to train the hand to represent them faithfully. In the first section of fine arts a second silver medal has been awarded to a group of water-colour drawings, Nos. 649 and 53, as evincing more than ordinary knowledge of the character of the animals represented, whilst due attention is paid to the careful working up of detail. A first bronze medal is also given to the group of oil paintings, Nos. 645, 648, and 646 (three oil-colour paintings by C. E. Brittan), being especially noticeable for careful finish of the coat of the grey mare and the harmony and truth of the whole work. A novelty occurs in the set of China painted plates and dishes (No. 658 by Miss C. Vivian), the flowers upon which, though not original, nor very highly finished, are yet very true in colour, and generally faithful in form, and if the result of only one burning, very meritorious. A book of etchings in pen-and-ink, No. 741 (etchings by E. F. Tuckett), is particularly deserving of notice as showing gracefulness of form, picturesque grouping, and playful fancy, rarely combined in mere sketching outlines. No. 669 (by J. Knight), a large water-colour drawing, though very uneven in execution, and crude in colour, exhibits patient care in the details of foreground, and in some parts such clearness and truth of colour as to give promise of very good work in future. No. 643 (oil painting by R. Lenderyou), though a copy, is the work of a sawyer, who shows how the leisure hours of a working man may be turned to account by the encouragement which is offered by such a society as this. Amongst miscellaneous objects connected with art, the collection of coins and medals and tokens on the floor below, and the fountain near it in the centre of the hall, deserve notice, the former as exhibiting the nucleus of what may become a useful historical collection, and the latter as helping to ornament the hall. In conclusion, the committee beg to offer their best thanks to the kind patrons of the society who have embellished the walls of the gallery with many interesting works of art, some of which have come from great distances. The beautiful portrait of Rosa Bonheur, by Dubuffe, was sent by Samuel Gurney, Esq., the member for Falmouth, and occupies a conspicuous place; and near it are two works by Ary Scheffer, which possess a special interest now that France has lost in him one of her most distinguished painters in a school in which he was almost without a rival in that country. For these the society is indebted to the kinduess of Mrs. Schwabe of Manchester.

Below them will be found some important works of our native artists, who never fail to assist in the cultivation of a more general feeling for art, by the contribution of some of their very best pictures. The judges would again direct the attention of students to the list of subjects for which premiums are specially offered by the society, in the hope that there may be, next year, a good competition in each subject, as there has been this year in most of them; feeling assured that it is by means of close adherence to the practical principles upon which these subjects are founded, that the native talent of our county will be most usefully trained to distinguish itself in a department which must ever exert a most important social influence.

Mr. Rogers then read the list of prizes in the fine arts department, and made some general observations relative to the merits and demerits of certain of the works to which premiums had been awarded. He stated that the judges had classified separately the £1 premiums which the society had offered last year for particular objects, and he expressed an earnest hope that in future years every one of these premiums would be competed for. The subjects for which the premiums had been offered were as follows:—1st,—For the best filled sketch-book from nature. 2nd,—For the best series of six flowers from nature in chalk or pencil. 3rd,—For the best series of six sketches in water colours of different rocks, showing their jointed structure and characteristics. 4th,—For the best water-colour drawing of the common bramble or blackberry, the red poppy, burdock, mallow, foxglove, or hemlock, strictly from nature, to be made separately the natural size. 5th,—For the above subjects in simple outline. 6th,—For six outlines of stems and branches of British trees on imperial-size paper, giving carefully the forms of leaves, and anatomical characteristics of stems. 7th,—For the best series of original sketches from Cornish antiquities, Celtic, Roman, or Saxon. 8th,—For the best series of six original outlines of the human hand or foot, life size, from the cast or from life, indicating light and shade by the lightness or strength of the outline. 9th,—For the best shaded crayon drawing of one of the busts in the Polytechnic Hall, full size, or the bust of any well-known character. 10th,—For the best isometrical drawing of a building in the county. And 11th,—For the best engraving on wood or lithograph. Towards the conclusion of his remarks, Mr. Rogers referred to the establishment and beneficial operations of the schools of design in the county, and said that it would be interesting as well as gratifying to all parents to know that the pupils of the Cornish schools of design had sent works to the central school in London during the last and present years, which had favourably competed with the productions of the pupils of the principal schools in the kingdom, including those of Manchester, Liverpool, and Birmingham. In conclusion, Mr. Rogers repeated the expression of his gratification at seeing so many and superior drawings and pictures as were exhibited on that occasion.

Prizes.—Section 1.—Marine View, Oil, R. Lenderyou, 15*s.*; Groups in Oil, C. E. Brittan, first Bronze Medal; ditto, Water-Colour, C. E. Brittan, second Silver ditto;* Sketches from Nature, William Gunn, £1; China Paintings, Miss Carry Vivian, second Bronze Medal; Statuette, Miss E. Dunn, ditto; Six Water-Colours, ditto, £1; Books of Water-Colour Drawings, Miss Hodgkin, second Bronze Medal; Watering-Place, Miss M. Lyle, ditto; Lilium Giganticum, Miss Gregor, 15*s.*; Bramble, A. L. Fox, second Bronze Medal.

Section 2.—The Cavalier's Pet, G. Appleton, 10*s.*; Outlines of Human Hand, Miss Bessy Squire, £1; Flowers from Nature, ditto 15*s.*; Chalk Heads, Miss M. L. Scott, £1; Outlines of Flowers from Nature, Miss Gatley, 15*s.*; Books of Etchings, Miss E. L. Tuckett, first Bronze Medal; Crayons from the Flat, E. Petherick, second ditto; Pencil Drawings of Flowers, Miss H. Fox, £1; Shaksperian Characters, Mrs. H. Prideaux, second Bronze Medal; Bas Reliefs, R. Pearce, second Bronze Medal.

STATISTICS.

The Rev. W. J. Coope read the following report from the committee on Statistics:—Only one paper has this year been sent for the consideration of the statistical committee; but this is a most valuable one, from Mr. R. Q. Couch, on the mortality of miners in the district of Lelant, being a continuation of his paper of last year. It has been submitted to Mr. C. Fox, Dr. Barham, and the Rev. W. J. Coope, who are all agreed in considering it worthy the second silver medal. The Rev. gentleman then observed that while this county depended so largely on its mineral productions, no

* On subsequent consideration, the judges awarded the distinction of the first silver medal to Mr. Brittan in the place of the two others previously given.

subject could be of more momentous interest than that which concerned the health and comfort of its mining population, and while the society was pursuing the discovery of those appliances which tended to economise the labour of the miner, it would be exercising a wise discretion by applying its resources to the promotion of the health, strength, and life of the miner. Mr. Couch's Paper was one of the most valuable character, as he had pursued his inquiries with a practical view. Mr. Couch had now followed his inquiries and laborious researches in the district of St. Just, by further inquiry in the district of Lelant, and he (the Rev. W. J. Coope) regretted to say with the same melancholy result. He had found that the mortality of the mining population not only exceeded that of every other industrial class in this kingdom, but even exceeded that of the household troops, which was considered by the *Times* newspaper some time ago to be so excessive. The committee considered this Paper so valuable that they recommended it should be published, and also that it should be granted the society's silver medal.

Prize.—Essay on the mortality of Miners, in the district of Lelant, R. Q. Couch, second silver medal.

NAVAL ARCHITECTURAL DEPARTMENT.

Capt. Caddy, R. N., read the report of the committee in this department, which, however, was confined to the list of prizes which will be found below.

Prizes.—Model of a Steamer, fitted with Geach's Patent Propeller, W. G. Geach, second silver medal. Model of a Clipper Ship, 1,200 tons, $\frac{1}{4}$-inch scale, Richard Tregenza, 15*s*. Model of a Steam Launch, with Launch fitted to illustrate Ship's Launch, R. Hancock, £1. Drawing of Frigate, showing internal and external fittings, R. Hancock, 10*s*. 25 Models of Ships, Boats, &c., Mr. Trescowthick, £5 or second silver medal. Drawing of Bell Buoy, G. Chowen, second silver medal.

NATURAL HISTORY DEPARTMENT.

The report of the committee in this department was read by Mr. Alfred Lloyd Fox. It was as follows:—It is with much pleasure that the Judges have to report a good assemblage of objects in this department, not so much in the individual excellence of any single collection, as in their variety, and the neat arrangement and classification of several of them, thus showing the interest that is continued to be felt in this important branch of natural science. There are many rare specimens of birds, eggs, and butterflies amongst them. One monograph only has been exhibited for competition this year, and the judges would recommend increased attention to collections of individual families. The ease with which *vivaria* of various descriptions are now successfully kept, affords great facilities for studying the habits of many different genera In exemplification of this, the judges would draw attention to two very interesting and valuable Papers now in the hall, one contributed by the well-known friend of the society, Jonathan Couch, Esq., of Polperro, on the exuviation of crabs; the other by the society's old friend, W. P. Cocks, Esq. Several very creditable collections have been exhibited by boys under 15 years of age, who, it is hoped, will feel encouraged to persevere in their pursuit of the study of nature. It is a study which peculiarly tends to develope the habit of observation, a method especially useful to the young, to enlarge the minds of all, and add greatly to the enjoyment of life. The report then concluded with a few general remarks upon a few of the contributions in this department.

Prizes.—Case of natural history, James Williams, 5*s.*; collection of British butterflies, W. C. Squire, 5*s.*; case of stuffed squirrels, and ditto of birds, James Couch, 5*s.*; four cases English stuffed birds, J. Jennings 20*s.*; eggs of British land birds, C. W. Fox, 10*s.*; collection of dried grasses, Mrs. W. Hocking, 5*s.*; collection of British eggs, W. C. Squire, 15*s.*; pan of *actiniæ*, C. Bullocke, 2*s.* 6*d.*; two cases of British birds' eggs, C. Phillips, 20*s.*; case of minerals, R. Batting, 2*s.* 6*d.*; essay on the exuviation of crabs, Jonathan Couch, second silver medal.

SCHOOL PRODUCTIONS.

Mr. Rogers read the report in this department, but it was confined to the list of the successful competitors.

Prizes.—*Section* 1.—side elevation of double-cylinder engine, J. V. Jeffree, 7*s.* 6*d.*; blowing-engine, Richard Chatten, 10*s.*; map of China, H. E. Sawle, 5*s.*; map of Cornwall, J. B. Murrish, 5*s.*; map of Australia, J. L. Kelly, 2*s.* 6*d.*; chronological map, A. Jenkins, 5*s.*; writing-book, H. E. Sawle, 10*s.*; ditto, Francis Hodge, 2*s.* 6*d.*; specimen of writing, W. Nodder, 2*s.* 6*d.*; ditto, W. Richards, 1*s.* 6*d.*; ditto, W. J. Richards, 1*s.*; ditto, J. L. Kelly, 2*s.* 6*d.*; ditto, J. W. Stephens, 2*s.* 6*d.*; ditto, W. Bryant, 2*s.* 6*d.*; ditto, J. Bowden, 1*s.* 6*d.*; ditto, J. Everett, 1*s.*

Section 2.—Five drawings from natural objects, Miss Mansell, £1; Etchings after Landseer, ditto, 2*s.* 6*d.*; outlines from cast of an ornamental scroll, Miss J. Gatley £1; sea view in oil, 10*s.* Group of natural objects, as a study of colour, Miss

J. Leverton, £1; three studies of flowers in pencil, Miss M. L. Jenkins, £1; chalk drawing from the flat, 2*s.* 6*d.*; chalk drawing of a pomegranate from the cast, Miss M. Solomon, 7*s.* 6*d.*; chalk drawing of a honeysuckle and rosette from the flat, Miss A. Carlyon, 5*s.*; a series of water-colour drawings, Mrs. R. Bell, 5*s.* *Male Students.*—Set of model drawings in pencil, Mr. J. L. Kelly, 2*s.* 6*d.*; set of shaded model drawings in pencil, Mr. Murrish, 2*s.* 6*d.*; series of outlines, 2*s.* 6*d.* oil painting of Queen Esther, Mr. W. G. Webb, 7*s.* 6*d.* Miss Mogridge, National School, Truro, for black board drawings, 5*s.* British School, Truro, series of black board drawings, 5*s.* Redruth School.—Water-colour drawing of flowers from nature, Miss Hocking, 15*s.*; Miss Reynolds, honourable mention for several chalk drawings of heads; Miss Cornish, honourable mention for outlines of ornaments; for the best chalk drawings of dogs from Bateman, Mr. G. Petherick, second bronze medal and £1; perspective drawing of Devon and Cornwall Bank, E. Gunmoe, second bronze medal; water-colour drawing, J. Francis, 2*s.* 6*d.*; Flushing from the river, W. Mayne, 5*s.*; Crayon heads, H. Bond, 2*s.* 6*d.*; Falmouth Harbour, H. Scrivener, 2*s.* 6*d.*; Drawing-books done in play-hours without assistance, J. H. Barclay, 5*s.*; shading from cast, Miss Solomon, 7*s.* 6*d.*; chalk from flat, honeysuckle, T. Lowry, 5*s.*; shaded drawing from flat, Miss Carlyon, 2*s.* 6*d.*; pencil drawing from objects, C. W. Fox, 2*s.* 6*d.*; water-colour, Miss Lucy Fox, 7*s.* 6*d.*; drawing-book, John Spargo, 2*s.* 6*d.*; ditto, Richard Jose, 2*s.* 6*d.*; Pendennis, B. Strongman, 7*s.* 6*d.*; old mills, at Helston, Sidney Clarke, 2*s.* 6*d.*; Bar Mill, G. C. Fox, 5*s.*; Pendennis, water-colours, — Sherris, 5*s.*; water-colour, — Martyn, 7*s.* 6*d.*

FANCY WORK DEPARTMENT.

Mr. Sydney Hodges stated that no report had been prepared by the committee, and after announcing the names of those ladies to whom prizes had been awarded, he announced the arrangements for the further proceedings of the society during the remainder of the day.

Prizes.—Linen shirt for special premium, Ann Edwards, special premium of 10*s.*; ditto, ditto, Mary Ann Moore, 10*s.*; the banners of war, R. Jewell, 10*s.*; Bracket in leather-work, Mrs. F. Rogers, 10*s.*; embroidered robe, Miss A. Bulley, 5*s.*; Berlin wool-work, R. H. Burgess, 5*s.*; silk patchwork counterpane, Miss C. Vigurs, 5*s.*; embroidery, 5*s.*; collar, Elizabeth Burton, 5*s.*

INSTRUCTION OF THE BLIND.

At the conclusion of the reading of the judges' Reports, a meeting of those members and friends of the society in favour of the effort which has been making for some time past in this county for the teaching of the blind to read and write, was held in the committee room of the Polytechnic Hall, Mr. J. Jope Rogers in the chair. A report of the efforts that had been made during the past year in furtherance of this object was read by the secretary, the Rev. E. Tippett, and it was resolved that the same should be printed and circulated among the subscribers. In consequence of the death of the very able and efficient teacher, William Baker, a second resolution was adopted, authorizing the committee to take such steps as they might think desirable to secure a successor in his (Baker's) place; and it was also considered desirable, wherever the funds of the society allowed, that the committee should adopt the principle of industrial teaching as a part of their plan.

In the evening a conversazione took place in the Polytechnic Hall, but it was only thinly attended. Several models were described and their principles explained, particularly Wheatstone's Gyroscope, by Mr. R. W. Fox, Mr. Hodges (the secretary), and others. This closed the proceedings of the day. It was announced that the Hon. Major Fitzmaurice would exhibit his Signal Lights this evening, but in consequence of unavoidable engagements in London, he was unable to attend.

On Thursday the exhibition was re-opened at ten o'clock, and shortly after visitors began to arrive in large numbers, a goodly proportion of them being practical miners, who inspected the various inventions and improvements intended to facilitate mining operations, with evident interest. A gratifying proof was afforded that the interest in this society has in no degree diminished by the fact that the attendance to-day was larger than on any second day of the exhibitions for some years.

Shortly after twelve o'clock Mr. R. Pearce took the chair, and in opening the proceedings, he said that the attention of the company would now be called to several instruments of an interesting and curious character, and any gentleman or lady who desired to have a closer inspection of them, or wished to learn their peculiar properties, might do so by coming upon the platform. He then called upon Mr. Sydney Hodges to read a Paper which had been prepared by Mr. J. S. Enys on Photography in connexion with Geology, to which he should request their attention.

Mr. Hodges first called attention to two sketches, showing the lower chalk strata at Beachy Head, and a series of seven photographs of granite rocks in this county. He then read the following Paper.—"It may be doubted whether Mr. Ruskin has rendered a greater service to geology, or the art of painting, by the correct delineation of the mountain structure in the 4th volume of modern painters; his sketches present a close approach to truth which is realized in a photograph. The publication of a series of photographs of fresh and weather-jointed structures of different rock formations could be made subservient to either purpose; though the artist and geologist might require different proportions in the series suited to their respective objects. The one requires only sufficient knowledge of the structural planes of rocks to comprehend their weathered surfaces; the other examines the weathered surface of exposed rocks to ascertain their internal character when fresh sections cannot be found. Seven photographs have been selected at Penzance by Mr. Henwood, which represent objects well known to the tourists. These have been pressed into the service of geology. The photograph of the granite quarry was taken to exhibit the jointed structure and cleavage of this rock, on which the commercial supply of granite so much depends. It shows the work done by 25 lbs. of powder in moving 470 tons of rock lying between two vertical joints parallel with the freeway cleavage, acting in a hole 5 inches in diameter, by 10 feet deep, which was placed about 16 feet from the face of the rock and about 5 feet from one of the vertical joints. The explosion is reported to have been scarcely heard at a distance of a hundred yards, and the sound was what is technically termed plumb, sure indications that the power exerted by the powder was only just sufficient to move its burden. The work done amounted to 22⅘ tons of granite lifted by 1 lb. of powder, a performance which has probably been seldom exceeded. The two slightly coloured sketches of Beachy Head looking east and west towards the same projecting cliff, which is situated at the spot where the upper chalk dips below the sea-level have been exhibited to show the influence of the jointed structure on the form of chalk-cliffs nearly 400 feet in length, when exposed to the quarrying influence of the sea at their base. These exhibit the geological permanence of change, occasioned by the constant fall of the cliff to the west parallel joint. It is needless to occupy the time of the meeting with further explanations of a scheme which best recommends itself to the eye, and which has been brought forward in an immature state in the hope of attracting the attention of photographers to a subject that seems deserving of their notice."

The chairman proposed a vote of thanks to Mr. Enys for his communications, which was agreed to *nem. dis.*

Mr. Hodges then exhibited and explained Professor Wheatstone's new invention, the gyroscope, remarking that it had not yet been applied to any practical purpose, but it illustrated the principal of *vis inertia*, or, in other words, it showed that a wheel revolving on its axis with great rapidity, evinced a proportionate resistance to any attempt to alter the inclination of its axis, and rather than do so would sustain a considerable weight on one of its sides.

Mr. Hodges next explained the properties of the Pseudoscope, another of Professor Wheatstone's inventions, and which has the effect of making a concave article, such as the inside of a hat, appear convex, and *vice versa*. These inventions excited considerable interest.

Mr. Sowell, of Penryn, exhibited a model of Blackett's Inaccessible Locks, which he proceeded to explain. This invention has been patented, and Mr. Sowell explained that the principle could be applied to the lock of any safe, as it did not interfere with the plan of any safe hitherto manufactured. It placed every conceivable difficulty in the way of the lock-picker or burglar, by the fact of the lock being at the back, top, or side of the safe, and consequently out of reach, except under the utmost disadvantages. The lock could not by any means be got at by boring or cutting, as the levers fastening the doors were absolutely beyond attack. And, if gunpowder were applied and the lock blown off, these levers would still hold the front of the door. The invention was considered by the gentlemen who examined it to be highly ingenious, and likely to prove of great value.

At about two o'clock a small party, not discouraged by the showery and windy state of the weather, started from the Custom-house quay, in Messrs. Taylor and Sons' steamer "Sydney," for the Helford river. The time was passed very pleasantly in making experiments with Wheatstone's Polar clock (a beautiful invention for telling the hour of the day by the action of colour on the selenite), and the gyroscope, which were explained by the secretary, Mr. S. Hodges. The party landed at about 5 p.m. at Trebah beach, a picturesque spot at the foot of the beautiful grounds of Mr. Charles Fox. A bountiful repast was prepared, and after about two hours spent on shore, where the views lighted up by the sunset excited much admiration, the party again steamed across the bay, thoroughly well pleased with their excursion. The best thanks of the society are due to Miss Hustler for her kindness in undertaking the arrangement of the excursion, and the excellent way in which it was managed.

Subsequently Mr. Hodges repeated his explanations of the novel inventions of Professor Wheatstone, for the benefit of such of the company in the Hall as had not heard them, and with this the proceedings of the day concluded.

On Friday the Hall was opened at the same hour as on the previous day: the attendance was again very large.

At twelve o'clock a meeting was held in the committee room of the Polytechnic Hall, for the purpose of considering the subjects of the education of miners, and the duties of engines; precedence being given to the former. On the motion of Mr. R. W. Fox, Mr. H. Tilly was called to the chair.—Mr. Sydney Hodges commenced the business by reading the following communication from Mr. R. Hunt, which has been sent to Mr. R. W. Fox:—

"London, September, 27th, 1858.

"My dear Sir,

"Notwithstanding that two attempts which have been made in Cornwall to introduce scientific education amongst the mining population, have not been sufficiently successful to lead to the permanent establishment of a mining school, they have each of them furnished proofs that there is a desire for the kind of knowledge which it was the purpose of those establishments to teach. My own experience, gained by intimate communication with the miners of the county, yet more strongly convinces me that on all sides it is felt, that with the continually increasing difficulties of mining, there is a necessity for that additional knowledge by which alone they can be successfully overcome. The agents and the miners have equally admitted that they should themselves be glad to possess a better acquaintance with mechanics, with mineralogy, and with chemistry, and that they should rejoice if it came within the limits of their means, to afford their sons the opportunity of acquiring those kinds of knowledge. It may appear, that two attempts to introduce science as a branch of education having been abandoned is contradictory to this statement. Examination will, I am quite satisfied, prove that the cessation of the Truro schools did not arise from any absence of the desire for knowledge on the part of the mining population of Cornwall.

"Beyond this I do not intend to offer a remark on the past experiments, my desire being to improve by the experience they have afforded, and to see a new organization attempted, which may possibly bring those advantages which belong to every variety of scientific training within the reach of all.

"'One and All' is the motto of the county, and by co-operation everything is to be achieved. My desire is to show that by a proper union of the mining interests of Cornwall, they may achieve for themselves the utmost benefits of improved knowledge, they may collect and preserve the results of their own careful observations, and they may benefit the commonwealth of science, by furnishing those facts by which alone the philosopher can ever truly interpret the phenomena of nature.

"The kind of education which the Cornish miner receives naturally makes him a careful observer, and it is only required that some system should be introduced to render his observations of the highest value. The boy on the dressing-floors soon learns to distinguish copper-ore from mundic, and jack from lead; he is trained to select that which is valuable, and reject the worthless. Habits of close observation are established. The young man goes underground, and, emulous of being a successful tributer, he soon learns to note peculiarities in the rock upon which he labours, and to mark the varying phenomena of the lodes through which he pursues his search for ore. Thus the education of the miner is a continued lesson of observation. Hitherto, although this excellent habit has been of value to the individual, it has been almost valueless to the community, because of the isolation of the miner, and it has not been to him so valuable as it might have been had he been trained to connect his observations.

"The miner can give knowledge while he receives instruction, he can communicate important facts, the result of his observations, whilst in return he is receiving that training, and that additional information which would be indeed 'a light to his path.'

"I do not admit the existence of that difference between theory and practice which is frequently urged. It is true we find one man standing on the surface and endeavouring to *think out* an explanation of the phenomena which are hidden beneath his feet, and, we find another toiling in the dark excavations of the mine seeing those phenomena, until they are familiar things to him, but who fails in one direction, as the mere thinker fails in another.

"A deductive system is the habit of one; he can generalize from the accumulation of facts, whereas the other reasons upon single instances, and fails to realize the larger and more important view. The two men talk a different language, the one is scarcely understood by the other; but is it not possible to bring them upon a common ground, where facts and ideas may be interchanged, where the miner may aid the philosopher with his practice, and the philosopher in return show to the miner how his theories serve to explain the difficulties which surround his observed facts?

"To effect this, it is not necessary that an expensive establishment should be organized. I believe that with the co-operation of existing institutions, a scheme could be devised which should meet all the requirements of my idea; which I must now endeavour to compose into a tangible shape.

"1st.—To organize an institution to be called 'The Miners' Institution of Cornwall and Devonshire.'

"2nd.—That this institution shall have as members, mine agents, working miners, mine proprietors, smelters, assayers, &c.,

and such scientific men as have paid any attention to those branches of science which directly bear upon practical mining and metallurgy.

"3rd.—That subscriptions shall be so adjusted as to be within the means of the young miner, or clerk in the counting-house, and that donations may be sought, in addition to annual subscriptions, from the other classes of members. The 'One and All' operation of members being required, I would suggest that the subscriptions should be arranged upon an exceedingly low scale.

"4th.—The objects.—Periodical meetings, at which papers might be read, and discussions upon mining subjects encouraged. That lectures should be given, those being confined to points of science, bearing on mining and metallurgy. That plans and sections of mines should be collected and preserved. That a collection showing the modes of working in other localities should be obtained. That drawings or models of mine machinery, tools, &c., should be exhibited, and as far as possible all modes of mineral exploration illustrated.

"Taking each of the mining centres of Western England, I would propose to establish local committees in each. They should meet as frequently as might be thought desirable, and carry forward in their respective localities the objects of the body. That from these local institutions communications, &c., should from time to time (every three or six months) be made to a general meeting, which should be held at different times, in one of four selected towns, well situated for the convenience of all. For the local meetings, there can be but little doubt the Mechanics' and Literary Institutions would be available, and for the general ones, I believe, there would be little difficulty in obtaining the co-operation of the County Institutions.

"Again, education of the miner, old and young, is the great object in view. To effect this, I would propose that the council, or general committee, who should be chosen from the body by themselves, should select according to the income at their disposal one or more well qualified persons who should associate himself or themselves with the local committees, and organize classes, and arrange lectures, at such times and in such places as might be determined on. Everything depending on the amount of support which such an institution would receive, it is not possible nor indeed is it expedient to do more than indicate arrangements. A Miners' Institution Journal, like those published by the South Wales Institute, and the Institution of Colliery Engineers at Newcastle-on-Tyne, might be issued periodically. I trust I have said enough to indicate to you sufficiently the idea which has for some time been floating in my mind, and which I desired personally to bring before the Royal Cornwall Polytechnic Society at its Annual Exhibition. My official duties unfortunately prevent my doing this, and therefore, may I request the favour of your reading this letter, or of explaining my views, in my absence. From the interest which you have ever taken in education, I leave the whole entirely to your judgment.

"My object is, and it has ever been one dear to my heart, to impart to the miner every advantage which science can give to mining, and to induce the miner in return to give to the man of science the great advantages of his practical observations. The benefits to be derived from such an organization would be mutually large, and I pray that 'One and All' may agree upon some method of realizing this great good.

"I am, my dear sir,

"Very truly yours,

"ROBERT HUNT.

"Robt. Were Fox, Esq., F.R.S., &c., &c., &c."

Mr. R. W. Fox then read a communication on the same subject from the Rev. John Punnett:—

"Clifton, September 14th, 1858.

"Sir,

"In the course of the last few years, measures legislative and voluntary have been adopted, with a view to the improvement, moral, intellectual, and physical, of the population engaged in our manufactories, and in the colliery districts of England and Wales. Of these measures, it may be questioned whether any one has been more beneficial than the Act of 5 and 6, Vict., c. 99, the immediate object of which was to prevent the employment of females and boys under 10 years of age in our collieries. Highly important, however, as was this special purpose, the practical working of the act has led to results still more valuable. The spirit and the manner in which it has been carried out have opened up a much wider range of operation and beneficial influence than was contemplated by the limited reforms, to which the mere *letter* of the law was originally restricted. Public attention has been directed to the whole condition and relations of the several classes in those districts to which the measure specially refers. All that bears upon the well-being of the manufacturing and colliery populations; the long and painful series of grievances between masters and men, leading to strikes, combinations, and their fruitful progeny of injustice, misery, violence, and crime; the responsibilities of the employer, and the distress of the employed; the dwellings and comforts of the colliers and their families; their moral and religious habits; above all (and it is upon this point that I now wish to fasten the attention of Cornishmen), the best means of developing the intelligence and promoting the education of the children of the labouring mining class;—these and other matters of vital importance to society have been brought under review—in all cases they have been thoughtfully and wisely handled; and, in many instances, difficult social problems, in connexion with them, have been put in a train of satisfactory solution. To the honour of Cornwall be it recorded, that these results are, in a great degree, due to the intelligence and perseverance of one of her sons, Mr. Seymour Tremenheere, the commissioner appointed to carry out the provisions of the Act, 5 and 6, Vict. His reports from time to time, laid before the Houses of Parliament, are replete with the most valuable information and suggestions. It is one of these suggestions, which has led to the happiest results, that I now desire to bring under the consideration of the Polytechnic Society, in order that a system which has been found so advantageous in other mining localities may be applied without delay to our Cornish population. Mr. Tremenheere's attention having been called to the state of elementary education in the districts with which as commissioner he was officially connected, two facts were forcibly impressed upon his mind; first, that, even at the best, his elementary education was, in many respects, imperfect; and secondly that, this imperfection is, in no small degree, attributable to the irregular attendance of the children, and the early age at which they quit school. In order to remedy these great evils, to obtain a better education, to secure greater regularity of attendance, and to retain the children in the schools to a more advanced age, he suggested the institution of what are now populary known over a large portion of the kingdom as the prize schemes in the mining districts. Associations were formed, and subscriptions entered into, among the owners of collieries, and others interested in the subject; prizes were offered, to be competed for, in public examination, by candidates from large groups of schools; and of these, the competitors, who came up to a certain standard, received a certificate of conduct and acquirement, besides rewards in money and books. Of these associations, covering a large portion of England and Wales, there are now *nineteen* at work and two in the course of formation. What has been the result of their operation, we learn from an official document of great importance. It is in the shape of a memorial, addressed to the Lord President of her Majesty's Privy Council, emanating from the honorary secretaries of the committees of the associations; amongst whom are the well known names of Sir Thomas Phillips and Pascoe St. Leger Grenfell, Esq. The whole of the document is full of interest, exhibiting as it does a remarkable instance of the effect of intelligent and benevolent combination among men of widely different views, even upon religious subjects, wheret hat combination is entered into in a charitable, enlarged, and liberal spirit. The memorial states that the prize schemes are accomplishing the objects proposed by them, to an extent that causes much satisfaction; that the number of candidates who presented themselves for the year 1856-57, amounted to about 2,500; that the prizes, both of money and of books, and the certificates of acquirement and good conduct accompanying them, induce many parents to cause their children to attend more regularly, and to remain longer at school, and stimulate the children to greater efforts; that the effect is felt, not only in the case of the successful candidates, but a large proportion of the children of the schools; that 'both churchmen and dissenters, have recognised, in these associations a common ground of action; and that, finally, in these associations where an examination in *religious* knowledge has been introduced, it has been done with very encouraging success.' In reference to this important and interesting feature of these associations, it should be mentioned as a gratifying fact, that though the examination in religious knowledge was voluntary, yet that in two of the associations, the whole of the candidates 'took the religious papers;' and, further, that two eminent prelates of our church, the bishops of Llandaff and St. David's, distributed the prizes to the successful candidates, children both of churchmen and dissenters. I have before me a report of the examination of the Monmouthshire Association, for 1858, which has just taken place. From that report, we learn that there has been a large increase of candidates, in the current year, over the number in the previous year, now 229 in all; that the whole of those who attended the examination, in the senior division, both boys and girls, to the number of 52, took the religious papers; and that their answers were so satisfactory that only six of that number failed in obtaining a reward. The examination was conducted by two of her Majesty's Inspectors of Schools, of whom I may venture to say, from my experience of men, that their tendency is not to fix too low a standard of the attainments of those who come under their inspection. Two inferences may fairly be drawn from these facts. The first is, that so far from there existing any repugnance either on the part of the parents or the children, to their receiving religious instruction, and being tested in their attainments in it, such instruction and such a test are almost universally approved by both classes. The second inference is, that in schools from which candidates had been drawn to compete for prizes under the scheme, the religious instruction conveyed to them, having special reference to these examinations, is sound and satisfactory, and has kept pace with the study of secular subjects. For more detailed information upon this great movement, in connexion with elementary education, among the mining and labouring population, and those immediately above them in the social scale, I would refer any one who may wish to obtain such information, to the valuable reports of Mr. Tremenheere, addressed from time to time to H. M. Principal Secretary of State for the Home Department. Enough, I think, has been adduced of the results of that which was, originally, a mere experiment, but which has now passed into the category of a great admitted educational success, to warrant me in calling the attention of Cornishmen to so important a subject; and in inviting them to do for *our* mining population, what has been done with such happy consequences, for the population under similar circumstances in other parts of the kingdom. I cannot believe that there is such a lack of public spirit in Cornwall, that any difficulty will be felt in obtaining the means of organizing in our own county, a system of wholesale encouragement to the moral and intellectual development of our miners—a system, which, emanating from one of ourselves, has shown itself elsewere so beneficial in its results, and which appears to be peculiarly applicable to our own case and exigencies. Looking at it in its bearings on the diffusion of a higher order of scientific intelligence among the various classes in connexion with our mines, the institution of the prize schemes, appears to me a step decidedly in the right direction. Among the collateral advantages contemplated by the promoters of the mining school at Truro, it was anticipated that by introducing sound instruction of the highest order, in all the practical and scientific branches of mining, a taste for such acquirements would descend as from a fountain head, and percolate through all classes associated with the great mineral industry of our country. There were those, however, who maintained that such a course was beginning at the wrong end; and that, if a more general diffusion of intelligence was ever to take place, and a higher standard introduced among our mining population, it could only be by disseminating, in the first instance, a sounder and deeper knowledge among those who labour with the pick and the gad. Whatever force there may have been in this argument, the system of prize schemes is in exact accordance with it. It lies at the very foundation of the ascending scale of intelligence. It deals with that important period in the mental life of every individual, the last year or two of his school instruction. It applies a stimulus to those who are in the transition state.

"In the event of a school of training for our miners being organized (whether similar to that which, on a small scale, is working so successfully at Bristol, or to the still more extended one which it is proposed to graft upon the University of Durham), either independently, or in connexion with our existing institutions in Cornwall, the operation of the prize scheme will indicate those who are most likely to profit by being submitted to a still more arduous course of instruction. The examinations having been made, to a certain extent, special, and of such a nature as to call out the taste and abilities of those, who might be expected ultimately to turn out sound scientific and practical miners, the successful candidates in these examinations, will naturally be chosen in order that they may be brought under the advantages of a superior education; and, instead of having to beat up and down the country for well qualified lads, to be trained in your mining school, you will have them ready to your hand, in those who will have already exhibited an aptitude for such studies, and a capability of progressing in them. A reciprocal action will thus be set up between the prize scheme and the mining school; the former will act as a feeder to the latter; whilst the school, by holding out its advantages to the candidates under the prize system will call into the field a larger number and a better class of competitors. On these grounds, therefore, as well as on many others that might be urged, I confidently venture to recommend the introduction of the prize scheme system into the county of Cornwall. There are two points, however, upon which it may be expected that I should not be silent;—and these are, the probable expense of the experiment, and the best method of initiating it in our county. With respect to the expense, I have been surprised at the important results which have ensued, from even so small an outlay. The Monmouthshire association distributed this year £81 : 5s. in money prizes and 121 volumes of books as rewards, making a total cost of less than £121; of course there are incidental expenses, connected with the working of the association; but taking this case as a guide for Cornwall (and it is an average one), we are safe in asserting that an annual subscription of £200, less than £1 on an average from each parish in the county, will be amply sufficient to work an association for Cornwall. It is not for me to say in what manner such an association may be most advantageously originated. If I might suggest, however, I should recommend that a sub-committee of the Polytechnic Society be appointed, to confer with a similar sub-committee of the Royal Geological Society and the Royal Institution of Cornwall; the first duty of these joint committees would be, in conjunction with any other influential men in the county, who would be willing to co-operate with them, to solicit subscriptions. I have little doubt that an application to H.R.H. the Prince Consort, whose readiness to support every hopeful educational project is well known, would produce a favorable reply on behalf of the Duchy of Cornwall. It may be thought by some, that I have laid too great a stress upon the religious element, in the working of the prize schemes. Be it remembered, however, that this is no essential part of the system; at the same time, I candidly avow that I have done so advisedly. Knowing, as I do, the Religious mind of Cornish men in general, I am fully persuaded that they will not regard with the less favour a scheme, which, while it has specially in view the progress of secular knowledge, at the same time encourages the young among us, to apply themselves to the attainment of that wisdom, 'the merchandise of which is better than silver, and the gains thereof than pure gold.

"I am, Sir,

"Yours faithfully,

"To the Secretary, "JOHN PUNNETT.

"R. C. Polytechnic Society."

Dr. Barham then entered at some length into the views of himself and colleagues of the Royal Institution of Cornwall on the subject, and the plans which they proposed for carrying out those views. After a very lengthened discussion it was agreed to refer the subject to the committee of the Polytechnic for them to report on to the Annual General Meeting. The subject of reporting the duties of Cornish Engines, on which some remarks will be found in another column, was then introduced, and it was decided that as soon as Mr. Lean and Mr. Brown could come to a mutual understanding the society would give the subject all the assistance in their power,

Mr. R. W. Fox, then read a letter which had been received by his brother, Mr. Charles Fox, containing some particulars of the boring machine to be used in the tunnel through Mount Cenis, and which, it was stated, was capable of boring through the hardest rock, for the reception of gunpowder preparatory to being blasted.

The meeting then separated.

On Friday evening the hall was again thrown open, and the excellent attendance and evident enjoyment of the company in the inspection of various objects of art and science placed the success of these evening exhibitions beyond all doubt.

On Saturday the hall was opened at the reduced price of sixpence and threepence, and the attendance was again so satisfactory that the committee decided on opening again on Monday, in consequence of which the drawing of Art Union prizes was deferred to that day. Sir Thomas Dyke Acland, in company with the president, Sir Charles Lemon, inspected the hall, and examined with great interest the various pictures and machines which were pointed out and explained by Mr. R. W. Fox and Mr. Hodges.

The following was the result of the drawing for the Art Union prizes:—

Mr. Brown, Falmouth	£20	0	0
Capt. Davey, Redruth	10	0	0
Mr. E. Smirke, Vice-Warden of the Stannaries	5	0	0
Mr. H. B. Champion, Feock	5	0	0
Mr. T. Johns, Falmouth	5	0	0
Mr. Cooper, Falmouth, Set of Engravings	1	0	0
Mr. J. Michell, Redruth, Photography	0	10	0
Mr. E. Smirke ditto	0	10	0
Rev. T. Phillpotts ditto	0	10	0
Mr. S. W. James, Truro ditto	0	10	0
Mr. J. B. Downing, Falmouth, ditto	0	10	0
Mr. J. H. Cock, Redruth ditto	0	7	6
Miss Cushman, London ditto	0	7	6
Mr. George Higgs, Penzance, ditto	0	7	6
Mr. C. B. Bone, Redruth ditto	0	7	6

A Statistical Investigation into the Mortality of the Miners in the district of Lelant.

By RICHARD Q. COUCH, Esq., M.R.C.S., &c.

In the present Paper I propose to examine, statistically, into the causes of the mortality of the Cornish miner, in the district of Lelant, which embraces the parishes of Lelant, Ludgvan, and St. Erth. In my former communication, I selected St. Just for examination, because it formed the extreme western boundary of the district which it would be in my power to examine; and I have now chosen Lelant, because it forms the extreme easterly limit. But these two districts are not so wide apart in their geographical position as they are in their topographical features. Without entering into any minute description of the physical characteristics of St. Just, it may be mentioned, that the whole parish is formed of an elevated *plateau*, untraversed by a single valley of importance, or interrupted by any line of hills. There are, however, many hilly undulations, but the flats are large and uncultivated. The western and northern shores are bold and surrounded by the Atlantic: the climate is uniformly cold in winter, but the cold is not excessive. The cottages are, for the most part, superior to those of the agricultural labourers, though they are not all that could be desired, and some are unfit for human habitation. In the district of Lelant, the physical geography is altogether different: within its boundaries are many high hills and a few deep valleys, and the water-shed of the county passes obliquely through it. On its north-east boundary it is exposed to the north and north-east winds, forming the south-west shore of St. Ives Bay, which is but little more than sand-hills, called Towans, entirely divested of vegetation. The valley of the Hayle river passes beyond the church-town to Penberthy in a south-east direction; and at Phillack, a wide arm of the sea runs in a north-east course, bounded also by barren towans. The southern limit of the district is a portion of the northern shores of Mount's-bay, where the climate is proverbially temperate, even in the depths of winter. About the centre of this district are the uncultivated hills of Trencrom, Trink, and Castle-an-Dinas, shedding their bleak influence over all around. Trink hill rises to an elevation of 652 feet above the level of the sea. The northern side of this hill slopes away into the "rocky downs" and towards the low and swampy flats of Towednack, and is hence quite exposed to the northerly and bleak winds of winter, and to the chilly easterly winds of spring. During the summer, the climate is mild and bracing. To the west, the ground undulates into the moors about Embla and the Lady Downs, where there is no shelter, either by trees or hedges; for all hedges are very low, and trees there are none. Towards the east, the soil is more cultivated; it gradually slopes towards St. Ives, having a hilly ridge from Penbeagle, on the north, to near Trevethow, on the south, lying between it and the sea. About a mile to the south-east of Trink hill rises the hill of Trencrom, which is about 550 feet above the sea-level. This hill is rocky and uncultivated, and, to the east, sweeps down to the wooded domain of Trevethow, the seat of W. B. Praed, Esq., and to the shores of the Hayle estuary. In a south-westerly direction, a few hilly undulations bring you to a deep valley, which, beginning about Embla and the Lady Downs, becomes a valley at Nancledrea, and deepens in a south-east direction, till it becomes a ravine. There is a stream of water which empties itself in the bog to the west of Marazion. About two miles to the south-west of Trink hill, in a straight line, rises the hill of Castle-an-Dinas; its elevation is 735 feet: to the north it slopes into the valley of Nancledrea, forming its southern boundary, and into the bogs and moors bordering the Lady Downs. The name of "Pig Moor," &c., given to the localities in this direction, very accurately describes the country: in the winter, a wet and bleak morass; and in the summer, barren, but refreshing. To the west, the soil becomes more fruitful and more cultivated where it borders on the parishes of Madron and Gulval. To the south, the slopes terminate in the fertile fields of Gulval and Ludgvan, and extend to the water's edge of Mount's-bay. The line of the hills is the line of the water-shed of the county; more rain falling here than anywhere else in the district. In the winter these hills are frequently covered with snow; while the lower slopes are green and fertile, bearing the crops for the early London markets. St. Erth is low and level; but, from being bounded in a south-east direction by the hills of Godolphin, Tregonning, &c., the line of greatest rain passes through it.

The population of the district divides itself into three classes,—the mining, agricultural, and mechanical. The mining is almost confined to the high lands. All the mines are to the north and east of the valley of Nancledrea, leading to Lower-quarter and Marazion; and the miners are confined almost exclusively to the same district. They live near and in Halsetown, and around the base and sides of the "rocky downs," Trink hill, and to the north of Castle-an-Dinas and the surrounding moors; a few residing in Ludgvan village, Lower-quarter, in the villages skirting the road to Hayle, and in Lelant: they live, therefore, in localities the most exposed to the inclemency of the weather. The agriculturalists are well situated on the cultivated slopes,—particularly towards the south and east. The mechanics live at and near Hayle, being engaged in the extensive foundries for mine machinery there; and their house-accommodation is good and comfortable. The cottages of the miners are most of them of worthless character, and altogether unfit for human habitation. On the Lady Downs, on Castle-an-Dinas, at the china-clay works, and the "rocky downs," if they are not in swampy situations, they are as exposed as possible; their only protection being the undulations of the ground. Many of them have only one floor, and only two rooms,—a kitchen and a bedroom. Others have two floors; but the kitchens are small, unfloored by anything but earth; the doors are either so much dilapidated, or are so badly made, that they freely admit every wind that blows; and the rooms are, consequently, cold and comfortless. In the bedroom, or, if there should be two, in the bedrooms, sleep all the family, however numerous. Crowding together of a family is common, and depends altogether on the number of which each family may be composed: in some cases, where the number of children, both boys and girls, is large, the crowding is by far too great; in some cases not allowing more than 200 cubic feet of air for respiration, and sometimes not more than 100. But this inconvenience is in some measure remedied by the fact that the wooden partitions between the rooms extend only to half the height of the ceiling, thus leaving the upper part free for the circulation of fresh air; and as the staircase very commonly passes up between the two rooms and is unenclosed, the air of the upper rooms is in common with those below. This, while it permits the access of the freshest air the house can supply, renders the sleeping compartments very cold and draughty. They are always open to the bare roof. The windows are extremely small and low, and very commonly incapable of being opened. In the lower and eastern part of Lelant, and in the neighbourhood of the church-town, the miners' cottages are much better. The same may be said of the cottages of the agriculturalists in the mining localities, but as a rule they are better and less crowded, for their children at a very early age go out to service and do not sleep home; but the children of miners, if old enough to work at the mines, always return home to sleep. The only exception to this crowding is when the men work in corps (cores).—In this case, they work alternately through the day and night; and by this plan much mischief is avoided, as all the family are not home at one time except on Saturday and Sunday nights. Some of the men are small agriculturalists, farming their land during the intervals of labour at the mine; but many of them have no occupation except mining, and as eight hours is the extent of their diurnal labour, the remainder of sixteen hours is spent in sleep and busy idleness.

The population of the district, according to the census of 1841 and 1851, is,—

	1841.	1851.
Uny Lelant....	1999	2290
St. Erth	2447	2457
Ludgvan	3185	3529

making the total population, in 1841, 7631. The census of 1851 shows an increase of 645 in ten years, the population being 8276.

In St. Erth, where the foundries are, the increase has been least, being only one per year; the greatest increase is in Ludgvan. St. Erth is the parish in which there is most agriculture and trade, and Lelant, in which there is most mining.

In order to estimate the proportion of deaths to the population under each year, I shall state the aggregate number of births per annum, so as to enable any one very easily to ascertain so important a point, with something like an approximation to the truth. But it must be remembered that there are several sources of error, such as emigration; and even migration, which is sometimes great, many people leaving one mine for another pass and repass from parish to parish with a ceaseless change. The agriculturalists are more stationary, and the farm labourers are almost always born in the same locality in which they pass the remainder of their lives; the parish is in fact frequently the extent of their wanderings.

The number of men engaged in mining operations within the district embraced in this Paper amount to about 1,000. But this must not be taken as even an approximation to the number *living* in the district; for adjoining are the parishes of Towednack, Zennor, and St. Ives, all of which send forth men to work in the mines of Lelant, &c. The tables of mortality have reference solely to the deaths occurring within a certain boundary; but the miners resident there may be and probably are much less than the number here indicated, which has reference to such as *work* within the district. In examining the statistics of St. Ives, this subject will be further examined and explained, and the proportionate per centage of deaths to population ascertained.

1837.

The number of deaths in the district for the period of six months, from June to December, is forty-eight, and of these, nine were miners, or 18·75 per cent.

Of these 9 miners,—

5, or 55·55	per cent. died of	consumption,
2, „ 22·22	„	pneumonia,
1, „ 11·11	„	paralysis,
1, „ 11·11	„	dropsy.

From this it appears that 77·77 per cent. of the deaths among miners were caused by diseases of the chest, and 22·22 per cent. by all other diseases.

There are no accidents recorded; one or two have been entered, but have been again erased.

The age of the youngest miner recorded is 26, and he died of consumption; the oldest, 70, and he died from age and paralysis. The average age of the miner is 48 years and 8 months.

1838.

The number of deaths during the year has been one hundred and twenty-nine; and of these, twenty-six were miners, or 20·15 per cent.

Of the 26 miners,—

11, or 42·30 per cent, died of consumption,
3·84 „ died of pneumonia,
3·84 „ died of asthma,
7·64 „ died of enteritis,
11·53 „ were killed,
15·38 „ died from old age.

Beside these, 1 died of diseased heart; 1 of disease of the brain; 1 of cancer in the neck; and 1 suddenly, at 48.

Diseases of the chest again cause 50·00 per cent. of the deaths, and the remainder arise from all other causes, including accidents.

The earliest age at which death occurs is 17, of which there are 3; 1 was killed; 1 died of diseased heart; and 1 of enteritis. The oldest died at 86 years of age. The average age is 48 years and 10 months.

1839.

The number of deaths for the year is one hundred and eighteen, and of these, seven were miners.

Of the 7 miners,—

5, or 71·42 per cent. died of consumption,
1, „ 14·28 „ died of fever,
1, suicide from insanity.

No accident is recorded; and the registrar seems to have thought that it was no part of duty to record death from such causes.

Thoracic diseases are still the most extensively fatal of affections. The youngest miner died at the age of 26, of consumption; the oldest, also of consumption, at 59. The average age is 39 years and 5 months.

1840.

The number of deaths for the year is one hundred and twenty-two, and of these, sixteen were miners.

Of the 16 miners,—

9, or	56·25	per cent.	died of consumption,
2, „	12·5	„	died of pneumonia,
2, „	12·5	„	were killed,
3 were not recorded.			

During this year, the mortality from thoracic diseases among miners was 68·75 per cent.; 12·50 per cent. from accident. The age of the youngest miner recorded was 20, and he was killed in the mine; the oldest was 72, and he sank from age and consumption. The average age for the year is 47 years and 6 months.

1841.

The deaths for the year have been one hundred and seventeen, and of these, fifteen were miners.

Of the 15 miners,—

11, or	73·33	per cent.	died of consumption,
1, „	6·66	„	died of rheumatism,
1, „	6·66	„	died of cystitis,
1, „	6·66	„	was killed,
1, „	6·66	„	died from old age.

Disease of the chest again predominates over all other causes of death. The youngest miner died of consumption at 20 years of age; the oldest, from age, at 79. The average age for the year is 50 years and 7 months. Population in 1841, 7631.

During the past five years, the greatest mortality has arisen from thoracic affections, and more especially from consumption. The relative per centages have varied very much when compared with the general population; but when the comparison has been confined to the class of miners, there is a very great uniformity of result through every year. During each year, many children are carried off by "debility," and generally under one year old. Croup is common, and several die of it every year. Measles, scarlet fever, and small pox linger about, carrying off several yearly; and whooping cough is always to be found in the district, especially in the secluded valleys, and on the sides of the hills.

Though deaths from fever are not very numerous, yet continued and typhoid fevers, with petechial eruptions, are very common: but the deaths are rare, as it is easy to procure fresh air. If the cottages had more comforts below stairs, and less people were crowded into the sleeping apartments, a few domestic arrangements would have the effect of reducing the fever cases very considerably. In the lower parts of the district, near Ludgvan, Lower-quarter, and where there are better cottages, and the bedrooms are ceiled off from the roof, fevers are more rare.

A Table, showing the comparative frequency of thoracic diseases in miners, and in the non-mining population, above five years of age.

Disease.	1837.	1838.	1839.	1840.	1841.	Average.	
Miners:—							
Consumption ..	55·55	42·30	71·42	56·25	73·33	59·67	68·15
Pneumonia ...	22·22	7·68	.....	12·50	.....	8·48	
Males, not miners, above 5 years of age:—							
Consumption ..	50·00	23·33	33·33	52·62	21·73	36·20	38·69
Pneumonia ...	.....	3·33	4·76	.....	4·34	2·48	
Females, above 5 years of age:—							
Consumption ..	10·00	10·51	24·13	33·33	33·33	22·26	31·72
Pneumonia ...	20·00	7·40	6·89	10·00	3·03	9·46	

The amount of thoracic diseases, and especially of tuberculous disease, in miners, is very great when compared with the whole of the non-mining population; but diseases of an inflammatory description are not numerous, except in particular years. In 1837, pneumonia very greatly prevailed, and it carried off 22·22 per cent. of miners and 20 per cent. of the female population. The next year in fatality was 1840, when 12·50 per cent. of the miners died of pneumonia and 10 per cent. of females died of the same disease, and in the average of five years, more females than miners died of it. It should be remarked, however, that many of the miners who died from pneumonia, as an immediate cause, were yet suffering from phthisis in different stages of development. The increase and decrease of the number of deaths from pulmonary affections in miners is generally accompanied by a similar increase and decrease among the general population; and the years of increase, I find on inquiry, have been years of great variations of temperature and other climatic changes, injurious to health. But, however much circumstances may vary, and one year may be more fatal than another, it is evident the general result bears the same unfavourable evidence of the great mortality of the miner over every other class.

During the last 5 years, deaths from thoracic affections among miners have been more than double those occuring among females during the same period, with an addition also of 5 years to increase the results, and among the male population it is also nearly double under the same circumstances: the average deaths among miners from chest diseases being 68·15 per cent.; among other males, 38·69 per cent.; and among females, 31·72 per cent.

The accidents are less in number than those occurring in St. Just. In 1837, which is but a partial record, no accident is entered. In 1838 there were two accidents and one sudden death; the accidents occurred at the ages of 17 and 19. In 1839 there were no accidents, excepting that one man committed suicide, from insanity, at the age of 33. In 1840 there were two accidents, at the ages of 20 and 25; and in 1841 one man died of locked jaw, from an injury received in his hand, at the age of 54. So that the same observation as was made in reference to St. Just may also be made here,—that most of the accidents occur to the young.

The thoracic diseases among the non-mining males are thus arranged: —

In 1840, out of five agricultural labourers and five farmers, two of each died of consumption; while of three trades (masons, carpenters, and blacksmiths), thoracic diseases were more common, and a *gentleman* died of gout.

In 1841, labourers and farmers died of consumption, &c., in a less proportion than miners; yet carpenters and other trades indicating in-door employment were more liable to chest affections than others. From the examination of the past five years, the ages at which mortality prevails, from tubercular disease, divide themselves into two groups: among the non-mining males the first period extends from 14 to 30, and the second from 44 to 64. In the first period, both the miners and male population generally that die are less in number than during the second period, and the point of greatest force of mortality is from 25 to 30. The second period, which is the most intense, has its greatest force from 53 to 64.

Among females, two periods of mortality are also observed, but the periods of greatest fatality are reversed; the greatest being from the age of 14 to 23, the period of the development of puberty and womanly charms.

1842.

The number of deaths for the year is one hundred and sixty, and of these, twelve are miners.

Of the 12 miners,—

33·33	per cent.	died of consumption,
16·66	„	died of pneumonia,
16·66	„	were killed.

Of the remainder, 1 died from dropsy, 1 from enteritis, 1 from age, and 1 from the effects of inflammation of the hand, arising from injury. The oldest miner died at 75, from age; the youngest, at 23, from consumption; and the average age for the year is 45 years and 5 months. From this it appears that 50 per cent. of the miners died of thoracic diseases, and 33·33 per cent. died from all other causes except accidents.

1843.

The number of deaths for the year is one hundred and thirty-three; of these, fourteen are miners.

Of the 14 miners,—

50·00	per cent.	died of consumption,
7·14	„	died of pneumonia,
14·28	„	were killed.

Of the remainder, 1 died of scarlet fever, 1 of brain fever, 1 suddenly, and the causes of death in the rest are not recorded. The age of the oldest miner is 70, and the cause of his death is not recorded; the youngest died at the age of 17, of brain fever. The average age for the year is 37 years and 6 months. From this it appears that 57·14 per cent. died of diseases of the chest, and 21·42 died from all other causes except accidents.

1844.

The number of deaths for the year is two hundred and thirteen, and of these, sixteen are miners.

Of the 16 miners,—

75·00	per cent.	died of	consumption,
6·25	„	„	from accident.

Of the remainder, 2 died of fever, and the causes of death for the rest are not recorded. The oldest died at the age of 75, of consumption; the youngest, at 16, of fever. The average age of the miner for the year is 45 years and 1 month. During this year, measles and scarlet fever prevailed as epidemics. Of the males below 5 years of age, 23 died of measles, and 10 of whooping cough; and of the females below 5 years of age, 26 died of measles, and 11 of whooping cough.

1845.

The number of deaths for the year is one hundred and nine, and of these, fourteen are miners.

Of the 14 miners,—

50·00	per cent.	died of	consumption,
7·14	„	„	pneumonia,
7·14	„	„	asthma;

and 2 died of fever, 1 of dropsy, 1 from age, and 1 is unrecorded. The oldest miner died at the age of 79, of fever; the youngest, at 21, of pneumonia. The average age for the year is 52 years and 10 months. During the year, 64·28 per cent. of miners died of thoracic diseases, while 28·56 per cent. died from all other recorded causes. No accident.

1846.

The number of deaths for the year is one hundred and twenty-seven, and of these, sixteen are miners.

Of the 16 miners,—

31·25 per cent. died of consumption,
12·50 „ died of pneumonia,
6·25 „ died of pleurisy,
6·25 „ died of hydro-thorax,
12·50 „ were killed.

Of the remainder, 2 died of cancer of the tongue, 1 of ulcerated leg, 1 of nephritis, and 1 is unrecorded. The oldest miner died at the age of 75, of ulcerated leg; the youngest was killed, at the age of 15. The average age is 43 years and 4 months. 56·25 per cent. dying of thoracic diseases, and 24·90 per cent. from all other causes.

In a review of the past five years, the same results appear; an amount of pulmonary disease occurs which more than equals all other causes together, and is much greater than what occurs in all the non-mining population.

Pulmonary Diseases among Miners.

Disease.	1842	1843	1844	1845	1846	Average.
Consumption ..	33·33	50·00	75·00	50·00	31·12	
Pneumonia	16·66	7·14	....	7·14	12·50	
Pleurisy	....	....	....	....	6·25	
Hydro-thorax ..	....	....	....	....	6.25	
Per cent. ..	50·00	57·14	75·00	57·14	56·12	59·08

Pulmonary Diseases among Males, not Miners, and Females, above five years of age.

Disease.	1842	1843	1844	1845	1846	Average.
Males:—						
Consumption ..	17·14	26·92	21·87	35·29	23·33	
Pneumonia	....	7·69	3·12	11·76	3·33	
Pleurisy	....	3·84	....	....	....	
Asthma	....	....	....	....	3·33	
Per cent. ..	1714	38·45	24·99	47·05	29·99	31·52
Females:—						
Consumption ..	18·75	22·33	45·71	34·21	27·50	
Asthma	....	....	....	2·63	....	
Pneumonia	....	...	....	....	2·50	
Pleurisy	....	....	....	....	2·50	
Per cent. ..	18·75	22·33	45·71	36·84	32·50	31·22

The year of greatest mortality from thoracic diseases among miners was 1844, when it reached 75 per cent.; and the same year was the one of greatest mortality among females from the same cause. But 1845 was the year of greatest mortality among the non-mining males: in examining the returns very carefully, however, the increase of deaths began in the winter of 1844, and in 1845 during the spring and summer was at its highest, hence it probably arose from the inclemency of the previous year, which had been so fatal to the other two classes. The spring and summer of 1844 were remarkably dry and cold; and thoracic diseases, especially pneumonia, were very prevailing, but not fatally so. After the dry and cold spring of 1844, however, all diseases had an aggravated character, and miners as well as the general population suffered severely. But whenever the general public suffer from affections of the pulmonary organs, the miners are sure to suffer in an increased proportion.

The accidents are not numerous. In 1842, there were two, and both were killed by rocks falling on them, aged 34 and 48. In 1843, two also were killed, but one only in the mine, aged 25, and he fell through the shaft; the other was drowned. In 1844, one, aged 17, was killed by falling. In 1845, there was no fatal accident. In 1846, there were two accidents: one, aged 15, fell in the shaft; the other, aged 54, was killed by a stone falling on him.

Among the other population, pulmonary affections are more common among carpenters than either blacksmiths or masons. Pneumonia is more common in the young and among smiths and masons: a greater age is attained by the farm labourer, farmer, and sailor than by the other classes. Consumptive diseases, among all the non-mining males, have their greatest amount of mortality, in the early period of life, from 13 to 26 years of age, its greatest intensity being from 17 to 21; a second period ranges from 40 to 67 years of age; at 40, consumption occurs only occasionally, and but rarely up to the age of 47; but from 50 to 57 years of age deaths are very numerous; after this they again rapidly decline; a few, however, occur to the age of 62, after which, to 67 years of age, they are again very numerous.

Among the females, consumption, according to the record of the last five years, begins to creep on at 11 years of age, and occurs occasionally till the age of 20, when it is at its greatest rate of mortality, after this it again declines till about 28 years of age; at the age of 36 it again commences, and, with much equality continues to 43 or 44 years of age, when it again decreases, but shows itself up to 65 or 66 years of age, and, in isolated cases, up to 77 years of age,—more sinking in a short space in the early period of life than in old age—two or three years in early life having more victims than any similar period in after-life.

1847.

The number of deaths for the year is one hundred and twenty-five, and of these, twenty-one are miners.

Of the 21 miners,—

47·61	per cent.	died of	consumption,
9·52	"	"	pneumonia,
4·76	"	"	asthma.

Of the remainder, 2 were killed, aged 18 and 37, 1 died of palsy, 1 of dropsy, 1 of fever, 1 of diseased stomach, 1 from age, and 1 is not recorded. The oldest died from age, at 81; the youngest was killed at the age of 18. The average age is 43 years and 7 months.

A great number of children, both male and female, died of "debility," 2 died of croup and whooping cough. Of the miners, 61·89 per cent. died of thoracic diseases; while of other males from 5 years old, 20·82 per cent. only died of the same affections; and among the females, 35·87 per cent.; and of miners only, 23·80 per cent. died from all other causes except accident.

1848.

The number of deaths for the year is one hundred and thirty-one, and of these, thirteen are miners.

Of the 13 miners,—

69·23 per cent. died of consumption.

Of the remainder, 2 died of dysentery, 1 from age, and 1 died suddenly. The oldest miner died from age, at 81; the youngest, at the age of 24, of consumption. The average age for the year is 53 years and 7 months. During the year, whooping cough was prevalent as an epidemic. And while 69·23 per cent. of miners died of consumption, 35·00 per cent. only of the other males, and 24·48 of the females, sank from the same cause.

1849.

The number of deaths for the year is one hundred and fifteen, and of these, seventeen are miners.

Of the 17 miners,—

58·82 per cent. died of consumption,
5·88 „ „ hydro-thorax.

Of the remainder, 2 were killed, 2 died of dropsy, 1 of nephritis, and 1 died suddenly. The oldest miner died suddenly at 77 years of age; and the two youngest were killed by a fall, at the age of 21. The average age for the year is 46 years and 11 months. Whooping cough and measles were mildly prevailing as epidemics, but

7 girls and 7 boys died of them.—A remarkably healthy year. Deaths were not numerous; the chief mortality being from debility among children, and consumption, palsy, and old age among the general population.

1850.

The number of deaths for the year is one hundred and forty, and of these, fourteen are miners.

Of the 14 miners,—

42·85 per cent. died of consumption,

14·28 „ „ pneumonia;

and of the remainder, 2 died from age, 2 of palsy, 1 of diseased brain, 1 of dropsy, and 1 was killed. The oldest died from age, at 78; and the youngest, at the age of 20, of diseased brain. The average age for the year is 44 years and 9 months. This was a very healthy year.

1851.

The number of deaths for the year is two hundred and sixteen, and of these, twenty-one are miners.

Of the 21 miners,—

38·09 per cent. died of consumption,

9·52 „ „ asthma and laryngitis.

Of the remainder, 1 died of nephritis, 2 of dropsy, one of diarrhœa, 2 of small pox, and 5 were killed. The oldest miner died at the age of 77, of consumption; and the youngest, at the age of 16, of the same affection. The average age for the year is 38 years and 9 months.

Small pox prevailed as an epidemic and carried off 21 males and 18 females under 5 years of age, and many died above this age of the same disease. Measles has almost disappeared. The small pox did not commence till June, and did not arrive at its maximum of virulence till July and August, after which it gradually declined.

Small pox, with measles and scarlet fever, when they occur together in the same district, do not appear to be severe. When they follow in succession to each other, this is not generally the case, each appears to run its course, and is mild or severe according to climatic changes and local influences; but as one decreases in power, another increases in virulence, and becomes more and more fatal. During the past year, small pox superceded all other diseases, and has been very fatal. The population in 1851 was 8,276.

Pulmonary affections are again the most generally destructive of all diseases among miners during the past five years:—

A Table of Mortality from Thoracic Diseases in Miners, in Males not Miners, and Females, above five years of age.

Disease.	1847.	1848.	1849.	1850.	1851.	Average.
Miners:—						
Thoracic disease	61·89	69·23	64·70	57·13	47·61	60·11
Males, not miners:—						
Thoracic disease	20·82	35·00	19·04	28·00	18·41	24·23
Females:—						
Thoracic disease	35·87	24·48	16·85	40·67	22·00	27·97

The greatest mortality among the miners from pulmonary diseases was in 1848, which was also the year of greatest mortality among the non-mining population; but the year of greatest mortality among the females was in 1850, when it was almost at its minimum among the miners. The mortality among any class of this population, such as agriculturalists and artisans, have been far less than among miners, and, as a large portion of the population of the district belong to these two classes, some estimate may be formed of the relative healthiness of each. The wages of a farm labourer is considerably less than that of the miner, and their family and household expenses are equal, yet the miner is the most unhealthy, and the agriculturalist the most healthy, of our industrial classes. This will be a subject for further examination.

The number of accidents is much less than what occurs in St. Just. In 1847, 2 were killed at the ages of 17 and 37; in 1848, there were no accidents; in 1849, 2, at the age of 21; in 1850, 1, aged 24; in 1851, there were 5, but 3 of these were drowned at sea, 1, aged 28, was killed by an explosion, the other, aged 22, met his death by falling into a shaft. These ages still indicate that accidental deaths are most common among the young.

It must be evident from these investigations, that this peculiar occupation will produce disease, and especially consumption. The great preponderance of consumption among miners over all other diseases, and the great excess of it in miners over other portions of the population, very strongly point it out. But a sad confirmation is clearly established in the recent returns on the health of our soldiers, that peculiar occupations produce peculiar diseases.

A soldier is a man arrived at manhood, and, at that period, he is selected with especial reference to good health. A soldier, to pass inspection, must be firmly and robustly formed, and healthy in every organ. He therefore enters on his duties not only in good health, but with every probability of its continuance; and yet, in a few years, this strong man withers and decays. This is not the result of accident, but long continued predisposing causes,—it can be accounted for in no other way. It has been found, for instance, that in proportion to the night-accommodation and occupation during the day is the prevalence of the disease.

Taking the number of deaths per ten thousand per annum of the soldiers' ages, we find,—

In the Household Cavalry........	110	die of consumption,
Dragoon Guards and Dragoons....	133	"
Infanty of the Line	187	"
Foot Guards	204	"
While 24 of our largest towns give...	119	"
Manchester, crowded and ill-ventilated	124	"
The London Fire Brigade, who are constantly up at night watching, and constantly wet and exposed.	70	"
The Metropolitan Police	76	"

The Foot Guards here suffer a mortality from consumption very nearly three times as great as the Fire Brigade; showing that night work and exposure do not of themselves cause all this mortality. Fully to understand these particulars, it would be necessary to enlarge beyond the bounds commonly laid down for your Report; but bad and insufficient bedroom accommodation and deficient occupation seem to be among the chief causes.

These facts cry aloud for remedy, and a remedy could easily be obtained; but bad as these facts are, they do not equal the mortality of the Cornish miners. The difference of the rates of mortality in the different regiments is according to the barrack-accommodation of the men. Where the sleeping apartments have been enlarged and the number of men occupying them reduced, the number of consumptive cases have also been reduced; but where no alteration has been made, the greatest number of deaths still continue to occur.

1852.

There died during the year one hundred and seventy-seven persons, and of these, twenty-one are miners.

Of the 21 miners,—

61·90 per cent. died of consumption,
9·52 „ were killed;

and of the remainder, 2 died from age, 2 of brain fever, and 2 died suddenly. The oldest died at 75, from old age; the two youngest died at the age of 17, one of whom was killed, and one sank from consumption. The average age for the year is 49 years and 2 months.

Small pox prevailed as an epidemic, and among the male children below 5 years of age, 10 died, and among the females, 5 died; but the greatest mortality among children arose from "debility,"—16 males and 21 females dying from this cause alone; being 43·24 per cent. of males and 55·26 per cent. of females under 5 years of age. Population in 1851, 8,276. Deaths, 177; births, 313.

1853.

There died during the year one hundred and eighty-three persons, and of these, twenty-three are miners.

Of the 23 miners,—

56·62 per cent. died of consumption,
17·39 „ were killed.

Of the remainder, 2 died of brain fever, 1 of dropsy, 1 of dyspepsia, and 1 of extensive ulceration of the thigh. The oldest died at 84, from old age; and the youngest was killed at the age of 18. The average age for the year is 40 years and 5 months.

Of the accidental deaths, one can hardly be said properly to belong to that class,—having committed suicide at the age of 25. Population in 1851, 8,276. Deaths, 183; births, 296.

1854.

The annual number of deaths is one hundred and sixty-six, and of these twenty-eight are miners.

Of the 28 miners,—

50·00	per cent.	died of consumption,
7·14	„	died of pneumonia,
3·57	„	died of bronchitis,
3·57	„	died of pleurisy,
14·28	„	were killed.

Of the remainder, 1 died of diarrhœa, 1 of dropsy, 1 of fever, 2 from age, and 1 died suddenly. The oldest miner died from age, at 88; and there are 2 others at the ages of 83 and 82, 1 dying from diarrhœa, and the other of consumption; the youngest died at the age of 23, of consumption. The average age for the year is 51 years and 2 months.

During the year, scarlet fever and measles prevailed as epidemics, but not to any alarming extent. Deaths, 166; births, 294.

1855.

The annual number of deaths is one hundred and forty-nine, and of these, twenty-three are miners.

Of the 23 miners,—

43·47	per cent.	died of consumption,
8·69	„	died of pneumonia,
4·34	„	died of inflammation of the windpipe,
13·04	„	were killed.

Of the remainder, 3 died of fever, 1 from age, 1 of dyspepsia, and 2 died suddenly. The oldest died from age, at 86; and the youngest, of pneumonia, at 18 years of age. The average age for the year is 44 years and 4 months.

This year was free from epidemics, except that an occasional case of scarlet fever occurred; but colds and fevers were common, although not of a very fatal character.

Deaths, 149; births, 231.

1856.

The annual number of deaths is one hundred and eighty-two, and of these, twenty are miners.

Of the 20 miners,—

55·00	per cent.	died of consumption,
5·00	„	died of inflammation of the windpipe,
5·00	„	died of bronchitis,
10·00	„	were killed.

Of the remainder, 1 died of lumbar abscess, 1 of apoplexy, 2 from age, and 1 of cancer of the penis. The oldest miner died at 77, from age; the youngest, of consumption, at the age of 20. The average age for the year is 53 years and 10 months.

One of the accidental deaths was from drowning, at St. Ives. Scarlet fever prevailed as an epidemic, and many died of it, both male and female; 13 males and 8 females died of it below 5 years of age. Deaths, 182; births, 276.

1857.

The number of deaths for the year is one hundred and forty-four, and of these, twenty-one are miners.

Of the 21 miners,—

42·85	per cent.	died of consumption,
9·52	„	died of pneumonia,
4·76	„	were killed.

Of the remainder, 3 died of brain fever, 1 of lumbar abscess, 1 of dropsy, 1 of enteritis, 1 of cancer, 1 of stricture of œsophagus, and 1 died suddenly. The oldest miner died at the age of 77, suddenly; the youngest, at the age of 12, of enteritis. The average age for the year is 41 years.

The greatest mortality among children as usual arises from debility and from whooping cough. Deaths, 144; births, 104:—this year has only a partial return of births.

The six years, terminating in 1857, are uniform in their teachings with the records from 1837, both in Lelant and St. Just; and from this uniformity, I fear we may anticipate the same result in an examination of the only remaining district to be examined. The mortality from thoracic diseases is always more than that arising from all other diseases combined, and in most cases is nearly double that found in the general population living in the same district.

A Table showing the frequency of Thoracic diseases among Miners, and among the general population.

Disease.	1852.	1853.	1854.	1855.	1856.	1857.
Miners:—						
Consumption...	61·90	56·62	50·00	43·47	55·00	42·85
Pneumonia	.....	.....	7·14	8·69	.....	9·52
Bronchitis	.....	.....	3·57	.....	5·00	.....
Males, not miners, above 5 years of age:—						
Consumption...	30·55	18·18	25·00	22·58	15·15	6·66
Pneumonia	2·77	9·09	.....	3·22	.....	.....
Females, above 5 years of age:—						
Consumption...	25·00	38·77	33·33	26·53	29·52	13·15
Pneumonia	4·59	2·04	5·12	8·16	4·54	5·26
Asthma	.....	.....	2·56	.....	.....	.....

The agriculturalists living in the same district have about 26·66 per cent., and the same with agricultural labourers dying of consumption, showing a great amount of mortality against the miner; and this must arise from the peculiarity of his occupation, or circumstances attending his habits. There can be no doubt but that the good health of the agriculturalists and sailors arises from their out-door occupation. No confinement in the bedrooms, even of the miner, can equal the closeness of the sleeping-places of sailors, where the air for respiration does not amount to one-fourth of what is required for health. Nor can exposure to the weather alone account for the result, for however wet the miner may get in his wanderings to and from the mine, yet it can never equal the wettings or drenchings of the sailor at sea. The diet of the miner, sailor, and agriculturalist are equally monotonous or uniform; but the occupations of the latter two are in the open air,—the work is regular, and thereis no spare time to hang on hands. The miners are therefore on equal terms with the others, except that after a crowding at home, their daily work is in as bad, or I would rather say worse, air than what they have left in their rooms at home.

The position of the miner is a peculiar one, differing from all others, and being worse than all others in what is generally thought to be injurious to health. Having to work underground, and most commonly at some miles' distance from his home, during the winter portion of the year, he goes to his work long before daylight, and does not arrive again to the surface till the daylight is on the wane towards evening; and thus, with the exception of the Saturday afternoon and the Sunday, he has for months together but little enjoyment of the light of the sun.

In my next communication, these points may be enlarged on so as to render intelligible the frightful mortality among miners.

The proportionate rate of mortality in children below five years of age is not so great as in St. Just; but this ought not to be expected in so mixed a population where cultivated farms and a farming population exist, and where there are many engaged in the manufactories of mining machinery; but if the deaths among children of miners be taken alone, it will be found that the rate of early mortality is much worse than what occurs in St. Just. The causes assigned, are "debility," "wasting," "marasmus;" and such names are fully justified by what I have myself seen in the district.

Some of the miners in the low-land districts have families of well-grown boys and girls; but every family lose some, and many can save only one or two out of a family of six or eight children. Among the population of the upper district, 65·04 per cent. of the males die below five years of age, and about 62·00 of the females below the same tender age; among the agriculturalists, about 35·00 per cent. of the males, and 33·40 per cent of females, die at the same age, but combining the two together, we are then rather in excess of the county, although not so much so as to excite alarm. But the deaths among the miners' children below five years of age are very numerous, and this does not arise from want of maternal care, for the mothers are equally careful of their offspring as the wives of farm labourers, although the number dying in the two classes is much against the miner: this probably arises from the health of the parents, the debilitated state of the father falling on the children.

Mortality among Children.

As this district embraces an agricultural and a manufacturing, as well as a mining, population, the results of a statistical examination into the mortality of children might reasonably be expected to differ in some measure from what was observed in St. Just. If each of these classes be taken separately, the most favourable will be found to be the agricultural, and the least so the mining. But the general mortality among the children, exclusive of the offspring of the miners, is above the average of the kingdom, and this might be expected, from the character of the district. There are several high hills and long extended moors and swamps, with but little protection from hedges, and none from cultivation or woods, except near and around Trevethow: the exposure is therefore great, and the house-accommodation is bad; and for children and their ailments the parents but rarely seek for medical advice.

In the following Table the deaths of childhood are ascertained in reference to the mortality of the district, including all classes; but in the second column the mining population is excluded altogether, and the deaths of children are estimated in reference to the general deaths of all classes, excepting those who are in any way connected with miners. From this it will be observed what an influence the mortality of the offspring of miners has on the general estimates. I have also confined the relative mortality to the male children alone, as it was intended only to show the difference between the two, without entering on the subject by a more extended examination. The children are evidently much affected by the constitutional peculiarities of the parents, and are less able to resist the inclemency of the weather than the children of other parents. But, in addition to this greater liability to disease, it must be remembered that most of the miners live on the northern side of the high hills and on the swampy moors, while the agriculturalists live in more sheltered and cultivated situations.

A Table of the Mortality per cent. in childhood, at and below five years of age.

Year	Males		Females	Year	Males		Females
	General population with miners	Population without miners	General population		General population with miners	Population without miners	General population
1840	60·00	45·45	42·82	1849	52·27	37·70	45·45
1841	47·72	35·59	39·93	1850	50·00	39·39	37·83
1842	42·62	35·63	40·84	1851	61·85	50·84	48·97
1843	55·17	44·44	49·18	1852	47·84	37·23	42·68
1844	68·31	50·42	60·95	1853	70·51	49·54	39·02
1845	52·68	38·46	33·33	1854	61·11	44·00	38·46
1846	38·77	28·78	31·34	1855	46·55	33·33	29·94
1847	50·00	38·02	27·27	1856	57·66	46·73	45·78
1848	57·44	45·00	33·33	1857	70·90	57·31	46·64

Age.

The age of the miner, if estimated from the returns of the registrar and from the returns of the workers actually engaged in the mines, will present precisely the same differences as were observed in examining the returns from St. Just. In the records the age varies from year to year; but the average age of the last twenty-one years is 47 years and 3 months. But the returns from the mines, in which all are included who are at present engaged in mining operations, whether at the surface or below, exclusive of carpenters and smiths, give the average age 30 years and 4 months. This conclusion is obtained from returns received from Wheal Reeth, Reeth Consols, Providence, Wheal Kitty, Wheal Margaret, Wheal Mary, and several other smaller mines. The difference between these two sources of information is about 17 years. The returns from the mines must be taken as the average of a *working* miner's life; the returns from the registrar, as the average period of death; and thus giving at the age of 47 years and 4 months a period of seventeen years of unproductive life, either from disease or accident. This is an early limit to active life for any class of men, and indicates the absence of much that renders life happy. The duration of the active life is, therefore, about eighteen years; but this period is much interrupted by sickness and accident, which, while they impair the constitutional strength, yet allow of a subsequent return to work, &c. From my private notes of attendance on the mines I find this interruption is far more frequent than with any other class of operatives in the neighbourhood. Many miners work for years with thoracic disease, while other operatives at the same age are healthy and strong. Occasionally I meet with a working man considerably above the average age who seems to be in the enjoyment of good health. To ascertain the cause of such longevity, I took twelve men, from 68 to 76 years of age, precisely in the order in which they were met at the mines, without any attempt at selection. Two of the oldest had not worked underground for nearly twenty years, as they felt so great a difficulty in breathing, that they could bear it no longer: one of these attended on the drying house, and the other did a little work at the surface and went errands. One man, aged 72, had worked underground from his 12th till his 18th year; he then worked at the surface; in a few years he again went underground; and has, up to the present time till the last nine years, changed every few years. Some worked at the surface in consequence of injuries received many years before; others are enginemen; but all, except the two youngest, attributed their longevity to their occasionally giving up the underground work. And some, who had always worked below the surface, were shaft-men, where the air was good and had direct communication with the atmosphere above. Such changes are therefore beneficial; and when a miner shows any sign, either of diseased chest or unexplained lassitude, which is the sure forerunner of disease, a month or two months' work at the surface would be of great benefit.

The black expectoration of Miners.

One of the most common circumstances brought under notice in the investigation into the diseases of miners is the jet-black expectoration. It has been noticed by many writers, and very elaborately by Dr. William Thomson. In his Gentleman's Paper, published in the Transactions of the Medico Chirurgical Society, a summary is given of most of what was previously known, and his own views are very clearly laid down. But, notwithstanding this, it is very evident that he has arrived at no definite conclusion derivable from personal investigation; and it may, perhaps, be doubtful whether any more satisfactory results could be obtained from such contradictory evidence as was submitted to him.

Some view the blackness as purely of extraneous origin, the sputa and lungs being infiltrated with carbonaceous matter from without; while others think it is generated in the lungs themselves, or in or by the bronchial glands. From these contradictory views being entertained by persons of equal position in our profession, it has been thought right to investigate the matter specially for these Papers. Among the Cornish miners, therefore, in no instance has recourse been had to the opinions of others, except as suggesting modes of examination, and as indicating the chief points on which further information is required. This seemed to be the most desirable plan to pursue. A mere summary of the opinions of others can be obtained in the Papers alluded to above; while original investigation can be obtained only by persons favourably situated in the mining districts. For these reasons nothing will be recorded but what has been personally observed.

In speaking generally of the expectoration, it may be remarked that it varies from a mere steel-gray tinge to that of a "coal blackness," but that it is most commonly of the deepest colour. The miners themselves do not consider it as indicative of any disease, and will, therefore, rarely refer to it, except in answer to some inquiry on the subject; and after a careful examination of twelve hundred men and boys, under almost every possible variety of circumstances, at all seasons of the year, in health and in disease, I am inclined to think their concusion is a right one. Diseases of the chest, and those of the most serious character too, are very common among miners, and are constantly associated with this black sputa, but not necessarily so; for while it occurs in cases of confirmed phthisis, it is equally constant in those who are free from all disease. It frequently happens, also, that men who are incapacitated by serious thoracic disease from working underground lose every trace of blackness by remaining at the surface for a few days; while the able-bodied and healthy continue subject to it so long as they follow their usual occupation. Neither is it confined to any age,—it is as common in the youngest boy as in the oldest man placed in similar circumstanees; but the quantity expectorated is much greater in old age. The women and girls employed during the day, either in sorting or dressing the ores, are quite free from it, and so also are the boys engaged about the stamps. It is, in fact, very rare indeed in any person engaged during the day at the surface working; but it occurs slightly in those engaged through the night. Those most liable to it, who work above, are the engine-men and fire-men; and those having it the least are the men landing the mineral at the shaft's mouth: this is done by candle-light. The engine and fire men have it most strongly marked the morning after the fire-places and flues are cleaned out. It is difficult to institute experiments on such men as miners: they are shrewd and very suspicious of any interference with their daily routine. Even questions are answered with caution, except to such persons as they well know. It is always best and easiest to act indirectly on the men by means of the agents or captains. An occasional experiment is sometimes necessary to elucidate a doubtful point not likely to be cleared up by the ordinary course of events; yet they fortunately need not be much employed, as every one having the care of mines must have frequent opportunities for accurate and extensive information.

The period at which boys most commonly commence their underground occupation extends from 9 to about 15 years of age, and about 11 or 12 years may be considered as the average. It sometimes extends to 19, and even 23 or 24 years of age; but these are generally the sons of persons engaged in agriculture; to such, mining is more than usually fatal. The sons of miners are trained early, first at the surface, and then afterwards they are gradually introduced into all the most laborious occupations below. The sons of agriculturalists, when they turn miners and plunge at once into all the difficulties and dangers of a very hazardous employment, suffer very severely. In endeavouring clearly to point out the character of the black expectoration as exemplified among the Cornish miners, it will be best, perhaps, to offer first a few facts illustrative of it in its most simple form, and then to advance to the more complicated and irregular cases. John James, aged 28, a fine healthy-looking miner, went first to underground employment at 11 years of age; he is the son of a miner; and from his 8th year had been engaged in the surface workings during the day. He always enjoyed good health till two years since, when he became subject to a tightness of his breath from working in bad air in the G—— mine; he changed to another soon after, and has been quite well ever since. The first mine he worked in was Wheal Reeth, and his occupation was to wheel the pieces of ore taken from the lode to the shaft before getting them removed to the surface. At this time, he worked 110 fathoms from the surface and about 50 fathoms from the shaft. He continued this occupation for four years, and was constantly going to and from the shaft. Being thus occupied, it was not necessary that he should be with the men while they were engaged in blasting the rocks: he, therefore, generally waited till all the powder-smoke had disappeared before he returned, as he could not see his way in or out till then. At this time he had no black expectoration; but it was much grayer than before he went underground. He did not suffer from any shortness of breath or headache, he enjoyed, in fact, good health; and the only inconvenience he suffered was on first going down, when for a few minutes, he felt as if he wanted room to breathe; but it soon passed away. At 16 years of age he removed to another mine and commenced working as a regular miner. He now remained in the galleries during all explosions and amidst all the powder-smoke like the other men. It frequently happened that the candles would not burn at all, and constantly they were obliged to be put horizontally, so as to allow the tallow to run into the flame. The boy did not observe anything particular the first day; but on the second, he found his expectoration "as black as ink." In this state it has continued ever since. There is not much expectoration under ground, or in coming up; but when at the surface, there is a great inclination to cough, "from the fresh air going down his throat." The blackness does not last long, it generally disappears before arrival home; but sometimes when much powder has been used, or the "air is very bad," it comes up for some hours, and sometimes till the next morning; but generally it disappears in about a half-an-hour. It lasts longer in the summer than in the winter; for during the hot months there is very much less cough on "coming to grass;" it is only after a walk and during the changing of the clothes that it is felt at all. This case is selected from many others as illustrative of the general progress of this black appearance, uncomplicated with disease; and it may be taken as an example of the mode in which it always makes its first appearance. In this case, however, it did not occur till the sixteenth year. To ascertain how early it would appear, I requested a captain to place a boy, who was about to commence his underground work, and who, from his general healthy constitution, I thought likely to be able to resist any deleterious influences longer than many others, with some men who were working at the 60-fm. level in a very close place. James B——, aged 11, a short, robust intelligent lad, had been engaged at the stamps for two years, and was very healthy up to the time of his going underground. His chest was sound, respiration natural, and his expectoration uncoloured. He first worked at 60 fathoms from the surface, and from 20 to 60 fathoms from the shaft. It was a close and very badly ventilated place. During the first day he did but very little work; complaining of headache and vertigo, and his expectoration became very dark. He was then removed to the surface again for a week, when all his former good health returned; but on again rejoining his companions below, he became much worse: he had an epileptic fit, but from which he recovered as soon as he was brought to fresh air. After this he was removed to a better aired place; but he has always black expectoration. He has constantly, for the last two years, complained of pains about the chest, with difficulty of respiration, and within the last six months has had repeated attacks of hemorrhage from the lungs. He is now 14 years of age and works at the surface; his black expectoration has entirely disappeared; but he has still tuberculous disease of the upper portions of both lungs, for which he is under treatment. The captain then selected other boys to go underground; but in consequence of the ill effects on B——, it was arranged that no one should go below in any ill-ventilated place for more than a day of eight hours during a week. Under this arrangement the boys kept in very good health; but the dark expectoration was observed in every case immediately on their return to the surface, and it disappeared during the whole of the intervening period.

The early history of the appearance of dark sputa is much alike in all cases, the chief variation being the period of its commencement; but even this arises more from the character of the employment, good or bad ventilation, &c., rather than from any individual peculiarity of constitution. All persons placed under the same circumstances give the same result, one having it, perhaps, darker or blacker than another. Attention to the employment is necessary to arrive at any satisfactory conclusion. On one occasion, I examined four men in succession who differed from any I had before examined; three had worked underground varying from twelve to twenty-eight years without any black discolouration of the sputa; but on further enquiry it was found that they had always been liable to a steel-gray expectoration, and that they had all been shaft-men and had generally worked at no great depths. The shaft having direct communication with the air above, I subsequently found, invariably gave less discolouration than any other part of the mine; and that the colour increased according to the depth, badness of the candles, and frequency of explosions. This fact is illustrated by the case of James, and may be still further shown by one of the cases alluded to above.

F. Winnan, aged 44, became a miner engaged in underground work at the age of 12, and his chief employment for three years and half was wheeling the ores to the shaft. After this he was engaged in sinking shafts for twenty-eight years. During the whole of this period he had good health, suffering from nothing but colds, much as other men; and he states that he never had any expectoration so dark as the men had, engaged in the galleries: it was generally of a blackish-gray, but varied very much, and disappeared always on arriving at the surface. About four years since, or in the twenty-ninth year of his being a miner, he first went into the galleries to work; but it affected his breathing very much: he felt as if almost suffocated, and his expectoration in two or three days became perfectly black. In about six months from this time he had a severe attack of pneumonia, from which he very slowly recovered; during his illness the sputa regained its natural colour. He has now returned to his occupation; his expectoration is very profuse and as black as it can possibly be. Below, he has but little cough; but on arriving at the fresh air, he feels it very irritating, sometimes producing fits of sneezing as well as coughing. The black sputa will sometimes, when there has been much blasting, continue for hours after the arrival at the surface, and even till the next morning.

J. R——, another miner, aged 53, worked in a shaft for ten years with only slightly discoloured sputa; but within three days after working in a gallery, the dark expectoration appeared, and has continued ever since.

D. S—— worked thirty-three years in a shaft with only occasional discolouration; but within one week after working on a lode, it became "as black as my hat;" and many other apparently exceptional cases might be cited, which may be similarly explained.

On several occasions I have tested the observation on myself.—Once I went about 90 fathoms below the surface, and about 100 fathoms from the shaft. At first, I felt great difficulty of breathing, with tightness about the forehead; but this soon disappeared, and I could get on almost as well as the men employed. The candles were burning dimly, and lying on their sides as the only mode in which they could at all be kept lighted. A large smouldering smoke was passing up just in front of the men. In the course of about an hour, three explosions were made, and although we were placed out of danger, yet the smoke was very great in all parts, and it was a long time before the men could return to their work. There being no draught, the smoke hung like a cloud through the level. I went from one part to another and remained below about six hours. On coming to the surface, I felt the air very sharp, and I might almost have drawn an outline of all the bronchial tubes, with their divisions and subdivisions, from the sensations which I felt, till it passed off towards the circumference as a generally diffused aura of chilliness. A teasing cough soon followed, and the expectoration was black with a sooty blackness; and this continued for half-an-hour, and then it continued with occasional patches and lines of blackness for several hours. I have on several occasions since made the same experiment and with the same result.

Cases similar to those narrated form the great bulk of what will be found among the Cornish miners; but there are some in which the blackness is much less intense and more quickly disappears, and there are few of the very opposite character, being not only most intense, both as to the blackness and quantity of the expectoration, but also as to the time required for its disappearance. All mines are not equally well ventilated, and consequently all are not equally well lit, and the accompaniments of heat and powder-smoke vary in equal proportions. Those mines that have the greatest number of shafts, by which the atmospheric air can be drawn down, are by far the most healthy. The candles, under such circumstances, burn best; the galleries are more rapidly cleared of offensive smoke; and the black expectoration is much less intense.

Having, on one occasion, been invited by a manager to visit one of his mines while the men were all assembled at their "pay," I was much surprised to find the men almost all healthy, and the expectoration, comparatively speaking, but slightly discoloured. This and other mines similarly arranged I have subsequently visited several times; and I think I may assert that the absence of much of what may be considered incidental to mining as injurious to health arises from the number of shafts, and consequently the well aired condition of the mine. The health of the miner would be considerably improved, and the working of the mine would be far more energetically carried on, if more attention could be paid to ventilation and similar other matters. There are mines, such as Botallack and Levant, which stretch far out under the sea: these could not, of course, be so worked; but even these, by winzes, valved shafts, and artificial means, could be better aired; and by so doing would be considerably improved. Some mines, on the other hand, are more than usually ill-ventilated, and these are more than commonly unhealthy. Miners are never very florid or robust; but to see the men from such mines arriving at the surface after eight hours' work, is a most sickening sight: thin, haggard, with arms apparently very much lengthened and hanging almost uselessly by their sides, they seem like men worn out rather than tired. The following case is taken from such a mine:—Samuel H——, aged 37, a thin, cadaverous-looking man, had been a miner since he was 16 years of age. He has worked in many mines, and at different depths; is neither a drinker nor a wrestler. He worked thirteen years before he had any disease of the chest, and had previously worked in tolerably healthy mines; but he had always the black expectoration on coming from his work. He preferred shallow mines. On going to work in the mine, he went to the 200-fm. level, and about 100 fathoms from the shaft, in a hot, close spot, where there was no fresh air, and the candles would not always burn, even when placed upon their sides. Though so deep, he could feel the effect of the wind at the surface; and when it blew from the south-west, he could hardly breathe; and he believed a coal or a wood fire would have been extinguished. His breath always was tight; he lost weight rapidly; and his black expectoration, after three or four weeks, never ceased except when he laid up for a few days; eventually it became constant. His cough was troublesome at times, and his voice, husky. This gave place to a wheezing sound, "as if the clacker of his throat leaked." He coughed up bright blood, and had pains about his chest. At this time I saw him. He had chronic bronchitis, with profuse expectoration of black sputa, and general derangement of his health. His black expectoration continued for eighteen months after he had discontinued his underground work. Employed at the surface, he recovered his usual colour; and although he also increased in weight, yet he never regained his former size or health.

William M——, another man from the same mine, was even more severely affected than H——; and symptoms of phthisis set rapidly in. He left; and having partially regained his strength, entered another mine, and to have better air, he worked nearer the surface; he took cold, had an attack of pneumonia, and died. During the eleven months he remained at home, he never lost the black sputa, and he died in that state. I had a post-mortem examination: both lungs were irregularly pervaded with black carbonaceous patches. The upper third of the right lung was one mass of tuberculous deposits, with small and irregular cavities. The left lung was equally tuberculated at its apex; but not so much disorganized as the right. The bronchial tubes were lined with a muco-purulent secretion, much of which was very black; the fluid of the cavities was also black. The smaller tubes were not only black, but a portion of the intra-tubular structure was also black. As the tubes decreased in size, and became numerous as they got smaller, in some places the dark matter went deeper into the substance of the lungs than in others; it had a very mottled or striped appearance, according to the section made. The walls of the cavities, like the tubes, were lined and permeated with the black secretions. A portion was hepatized and easily broken down. There were old adhesions between the pluræ. In post-mortem examinations of men who have died immediately after leaving their work, or who have been killed while underground, the black expectoration has, as it were, been found *in situ*. The slighter cases have shown that the secretions alone have been tinged, and the mucous before the muco-purulent. This is observed in ordinary cases of bronchitis. It has been my misfortune two or three times to have rather severe attacks of bronchitis; and on these occasions

I have had the candles used by miners to burn on a table near the bed. After the first burst of the cough, and when the expectoration had remained for a time undisturbed, I always found it tinged with the gray discolouration of miners. Since then I have observed it in many patients, that just as the cough is getting a little chronic, the thinner portions of the sputa are constantly of a grayish colour in the evenings and early in the mornings; and this is greatly increased if there has been a fire near. It rarely happens that the purulent matter is tinged except at its surface. The first part affected with discolouration is the mucous membrane of the bronchial tubes, just below and around the befurcations; after this, the most frequent parts are the smaller tubes, and finally the cells. After the mucous membrane has become affected, it gradually extends to the substance both of the tubes and parenchyma of the lungs themselves. This is the result of numerous examinations after death. It seems to be a needless task to give the result of the examination of every individual case. I have classified those I have examined according to the symptoms observed during life, and the result seems to be just what has been stated.

It has been remarked by a few observers, in the cases of some men who have been subject to this form of expectoration, that it arises from a peculiar thoracic cause, from the fact that it has been observed in men who have taken to the sea after having been engaged in mining occupations. I have seen the same, and I have examined the companions of such men, who have been sailors ever since their boyhood, and the same appearance has been common to all while on board. The cooking-place on deck, or the forecastle below, are just such places as might be expected to give rise to it. These men I have afterwards seen ashore, and then they have been as free from it as other people.

Cases of extensive discolouration of the lungs in Cornish miners are very rare. I have never seen but two cases, and only one of these could be at all considered as approaching to what I have heard of the blackness in the lungs of the colliers, both of Wales and of the north, forming a true melanoses of the lungs.

From all that I have witnessed in mines in general, and from twelve hundred cases that I have particularly examined, I am convinced that the whole of the discolouration arises from external causes; and the chief of these are the breathing of smoke of the powder in blasting rocks, candle-smoke greatly increased from air deficient of oxygen, and smoke from fires; or, in a few words, carbon in minute division from any source will produce it.

I have found black sputa in engine-drivers on railways as well as in their assistants, in smiths, and in other persons who work under similar circumstances. Symons, a man who had been engaged on a railway ever since he was a boy, consulted me once in a great fright that he had been "spitting up stuff as black as his hat." He had before always been engaged with the luggage train till four months since, when he went into the fitting shop and worked as a smith. After remaining there for some weeks, he discovered that his expectoration was dark; he became frightened, and left, as he fancied he was "undermining his constitution." There being no place vacant for him for a short time, he became attached to the engine, and the blackness continued. A few days' holiday has, however, dispelled all his evil forebodings, and he is now quite well.

I have seen black expectoration in boys, in young men, in old men, and in persons of all ages working under similar circumstances. It is more profuse in men than in boys; and it is a constantly observed fact, that the expectoration of men working in deep mines, and far removed from the shaft, is more profuse than boys, and far more so than in persons of the same age in ordinary occupations. Miners have very commonly profuse expectoration without much disease. A mucous membrane in a state of health pours out a certain amount of secretion which seems necessary to health; but if that membrane be lessened in tone, or relaxed in texture, a larger amount of secretion or exudation than is natural immediately follows. So long as the membrane continues in this flaccid state, so long will this chronic exudation continue. Miners are particularly liable to this chronic relaxation of the bronchial tubes, and hence a profuse secretion follows, and the black expectoration is abundant. But in all the cases I have examined, save one, the black expectoration seemed to be derived from extraneous sources.

Conclusions.

The most probable conclusion to be derived from the foregoing remarks is, that the matter producing this blackness of the expectoration is derived from without, and from carbonaceous matter of the powder and candles.

In the first place, because—

It is not found in any of the men or boys engaged at the surface in the open air during the day.

2nd. It is found in all men who are exposed to smoke or dust.

3rd. That its intensity is in direct proportion to the exposure of the men to smoke, and to their removal from good air.

4th. That it appears and disappears just as the men are exposed to the smoke and dust or removed from it.

5th. That the first part affected is the bronchial secretion and not the tubes, or that part which is exposed to the air.

6th. That the first structural part affected is the mucous membrane, and subsequently other parts toward the parenchyma.

7th. That its microscopic appearance is that of carbon derived from smoke.

A particular description of some circumstances hitherto little known, connected with the process of exuviation in the common edible Crab.

By JONATHAN COUCH, Esq., F.L.S, &c.

In the Report for the year 1843 of the Royal Cornwall Polytechnic Society, is published a Paper on the process of exuviation in Crabs and Lobsters; and it appears to have been principally by means of observations there recorded, that this very remarkable natural action is now commonly held as an undoubted truth.

It had indeed been partially observed long before this by a few eminent writers; and in addition to the authorities referred to in the Report quoted above, Olaus Wormius in the early part of the 17th century speaks of it as a thing not doubted; but the fact was still doubted, or disregarded by the generality of naturalists; and it was subjected to close experimental enquiry by no one except that excellent French naturalist Réaumur:—who had studied it in the river crayfish (*Astacus fluviatilis*,—Bell's Br. Crust. p. 237); of which he remarks a portion of the process that has not since been noticed by other observers, and on which his observations have been the less regarded, because it is beyond a doubt that different species or families of crustaceans pass through this function with considerable variety of manner.

As the writings of this naturalist have not come within my reach (and indeed his observations on the subject now under consideration do not appear to have been reprinted from the Memoirs of the French Academy in which they first appeared, in the year 1718), I owe my knowledge of them to Mr. Bell's well known History of British Crustaceans, in connexion with Mons. Milne Edwards' general History of the same family: Mr. Bell says—p. xxxv.—"It is impossible to imagine that the crust of the legs, and especially of the great claws of the larger species, could be cast off unless it were susceptible of being longitudinally split;" and Réaumur states that such is actually the case; each of the segments being composed of two longitudinal pieces, which, after separating to allow of the passage of the soft limb, close again so accurately that it is very difficult, in the cast crust, to discover the line of division. Mr. Bell goes on to say:—"In a recent interesting account of the exuviation of a *Maïa* (Corwich crab) Mr. Gosse has however shown that in this brachyurous form, no such splitting of the legs takes place, but the animal pulled first at one end and then at another, until they were quite out, as if from boots." Milne Edwards' observations are to the same purport, and equally with those of Mr. Bell show how little the process is understood, even by the most eminent naturalists. "It is clearly to be discovered," says he (Vol. I. p. 54), "that if the substance of the tubes which confine the limbs do not split asunder lengthwise, it is not easy to understand how these members can be withdrawn from their case." In a note he adds, "In their ordinary condition the divisions of the legs appear to be formed, each one of a single tubular firm crust;" but Réaumur tells us that they are framed of two almost equal halves, joined together lengthwise; and which separate when it becomes necessary for the leg to pass through: after which the parts fall together again so closely as to render it difficult to discover the place where the separation was made.

That in my former studies of this process I had myself overlooked or misapprehended the mode by which the claw-legs were withdrawn from the loosened crust, is in the first place to be ascribed to the fact, that my attention was chiefly occupied with what was going on in the body, and its immediate organs, the eyes, antennæ, and inward frame; and in the next place to the circumstance, that the portions of the legs which alone answer to Réaumur's description in any degree are by their situation hidden below the under portion of the carapace, to which they are pressed close by the principal joints of the legs themselves, so that they could not have been attended to without a greater degree of violence than I judged myself warranted in using, with due regard to the other observations I was desirous of carrying out. To this must be added, that as soon as the process of exuviation is completed, the separated sections fall together again so closely, that without being prepared to expect it, no suspicion is likely to be felt, that the parts had ever been drawn or thrust asunder.

The example of this process which first obtained my attention, was a female (technically a hen crab) of the stage of growth only one degree short of the full size; and it was found in the month of June, in a crab-pot into which it had crept, as would appear, when the action of exuviation had newly set in. Its death after being taken from the water was much quicker than is usual with crabs in their ordinary condition; and as the process of ecdysis was thus cut short when it had advanced only to about two-thirds of its extent, an opportunity was afforded of noticing and making sketches of the particulars at leisure.

The edible crab (*Cancer Pagurus*, Bell's Br. Crust. p. 59) is more inert than most other crustaceans when passing through the process of exuviation; for some others of the species appear to effect this object with a jerk, and are as active presently afterwards as at other times. But in this crab it more nearly resembles a merely physiological action, in which the will has little concern; and even conscious effort is scarcely perceptible. On this account it occupies a considerably longer time than in the case of, at least, any of the long-tailed races.

It was evident from an inspection of the proceeding in this specimen, as it was known to me before, and is confirmed by a close examination of several others which have been obtained since, that (to use the words of Mr. Gosse in regard to the *Maia Squinado*) —the smaller legs are drawn out of their bony cases as a leg out of a boot, and therefore the language quoted from Réaumur will not correctly express what takes places in the common crab; nor, I believe for reasons presently to be assigned, even in the species on which his observations were made—the river crayfish. The bony covering, where this remarkable process takes place, is not simply divided by splitting, but by a far more complicated action;

which yet is beautifully expressive of the simple means to which creative wisdom has had recourse when a natural proceeding was to be regulated. A reference to the figure (Pl. I.), which was sketched while the proceeding was in action, will best express my meaning; and the sketch itself may be compared with specimens I have the pleasure of producing before the meeting. Substances are inserted in the openings, the better to afford a view of what became expanded, and what remained closely attached to the firmer organization.

As I have already said, the specimen particularly referred to was, when it came into my possession, in the midst of the act of exuviation, and I took the opportunity of sketching a figure of it in that condition; but my attention was chiefly engaged with some particulars not observed before, and which at any other stage of the process were not likely to be observed, on the inner and more concealed portions of the claw-legs.

It is known that the muscular substance of the common crab at the time of exuviation is exceedingly soft and flaccid; and the motions of its parts as the process advances are very inert. As the body, therefore, passes backward out of its case, the soft imprisoned flap or tail becomes tightly pressed, so that the sides of this organ are made to overlap the middle ridge. These sides of the flap also cover the hindmost legs; and as well they and the next pair are squeezed tightly together. One of the smaller legs had been broken off when I received the specimen; and this appears to have been done by the fishermen in handling it. But although the substance of the flesh was soft as dough, the cicatrix had formed as effectually to prevent the bleeding, as it does usually under the circumstances of perfect health.

But the most remarkable part of the process, and that which particularly leads me to present this communication to the society, is what I found to take place in the larger or claw legs.

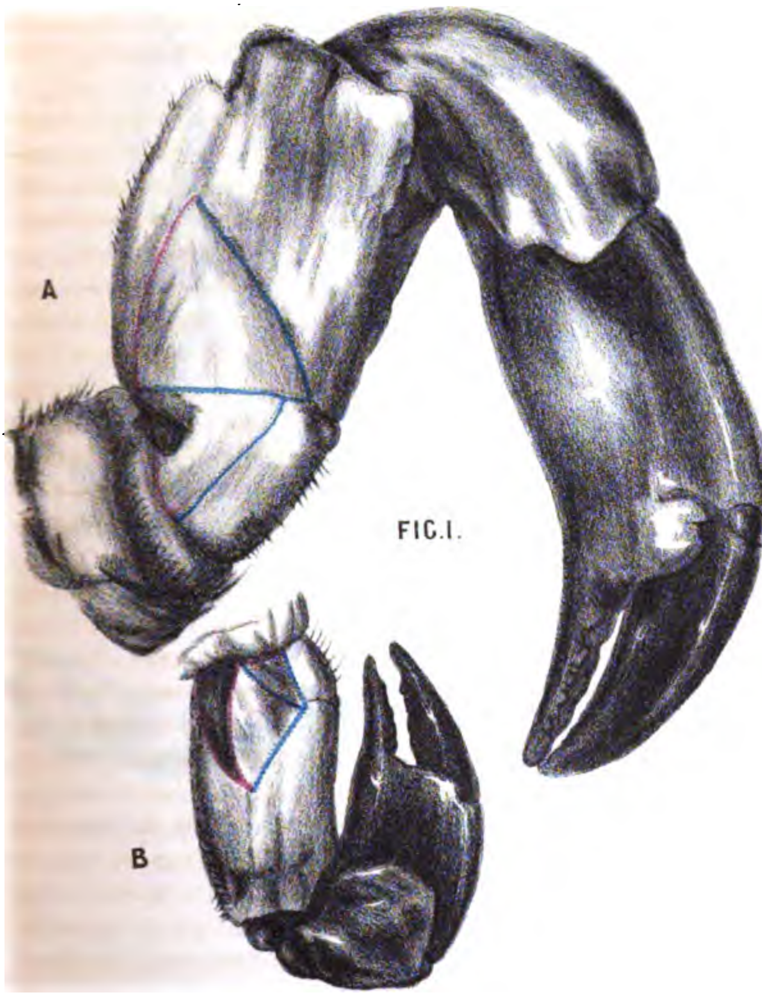
In these the flesh of the two outer sections is much shrunk; but the portion occupying the third, or innermost, is on the contrary very much distended. This is especially seen on the inner concave surface of this portion of the limb; where, if we examine the part under ordinary circumstances, we find three lines, which meet at an angle, their diverging extremities being bounded by a curved border, that is directed at its termination towards the body of the animal. As a preparation for exuviation, in the same manner as the well marked line in front of the carapace or shell, between its margin and the mouth, becomes loosened by absorption, so this curved line on the claw-leg has become separated along its course, while the other lines (those which are straight and meet at an angle) are only so much changed from a firm crust, as still to remain connected together by a membrane, and thus assume the nature and offices of moveable joints or hinges. The hitherto firm structure of this part of the claw-leg being thus turned into a moveable cover which admits of being lifted at the curved circumference, the swoln portion of the limb is protruded through the opening, and by the tension thus produced below the wasted extremity is drawn downward, the greatest accommodation of space being thus afforded with the least expenditure of effort or displacement.

In the specimen examined, I found that a portion of the muscular substance of the limb had become so much distended as to be thrust out of its sheath, and partly wrapped round the outside of the loosened crust. But while this may be supposed to be of great mechanical use in drawing downward the remaining wasted portion of the limb occupying the more distant segments, it offers but a slight hindrance to the final passing of the whole through the final ring or *coxa*—where the leg is united to the body:—for, this last remaining space is narrow; and the distention being chiefly produced by a liquid diffused through the fleshy fibres, it offers but little positive obstruction to the passage. A dragging action therefore, accompanied probably by a muscular contracting power, is all that is required to enable it to slip through; at the same time that a portion of the distending fluid, if not the whole, is so much thrust backward as still to occupy the opening, and thus contribute to bring down each successive part in turn. The extremity of the claw-leg then, being not only smaller naturally, but more wasted in this process than the rest, finds no hindrance to its escape, and thus the imprisoned limb is set at liberty. It is a fact beyond doubt, as appears by examination of many specimens, that no splitting process takes place in the slender or walking legs; but that, to use an expression already quoted, they are simply drawn out of their case as the human leg is drawn out of a boot.

It is a matter of some interest, to ascertain whether and to what extent this remarkable process takes place in others of the great family of crustacean animals; and I have exercised no small extent of effort in following the examination in species of both the sections: the long-bodied, or lobster kind, and the short-tailed, or crabs. So far, however, my exertions have not been attended with satisfactory success, for want of opportunity in obtaining the proper specimens. For the present therefore I am compelled to content myself with submitting to the society a series of sketches of the corresponding parts to those of the edible crab, as I have found them in the species named in the drawings; from the great similarity of which, although the distribution of the lines varies, I believe myself warranted in expressing my conviction that in the exuviation of their claw-legs, they all pass through a similar process.

Nothing of this kind appears in the Corwich crab (*Maia Squinado*); *Corystes Cassivelaunus*; the common crayfish (*Palinurus vulgaris*); or the various species of shrimps. We may therefore conclude that all the limbs in those instances are withdrawn from their covering in the same manner as the smaller legs in the edible crab. The river crayfish, *Astacus fluviatilis* (Pl. II. fig. 1), — the particular subject of the French naturalist's researches, as well as our common lobster (Pl. II. fig. 2), have such lines marked on the inner segment of their claw-legs, as leave no doubt in my mind that an opening takes place in them when the process of exuviation proceeds: although not such a mechanical splitting as Réaumur describes; and it does not take place in any shape in the smaller or walking legs.

The same may be said of the common harbour crab, *Carcinus Mænas* (Pl. III. fig. 1); *Xantho florida* (Pl. II. fig. 3); the velvet crab, *Portunus Puber*, and *Pusillus* (Pl. II. fig. 4); and *Atelecyclus Heterodon* (Pl. III. fig. 2); — all which I have examined, and of which I submit sketches to the society. In the



Claw-leg of the Common Edible Crab as engaged in the process of Exuviation.
A. *The moveable portion with the hinges closed.*
B. *The hinges lifted and open.*

Vibert, Lith. Penzance

[redacted]

FIG. 1.

River Crayfish

FIG. 2.

Lobster

FIG. 3

Xantho Florida

FIG. 4.

FIG. 4.

Velvet Crab

... Lith. ...

FIG. I.

River Crayfish

FIG. 2.

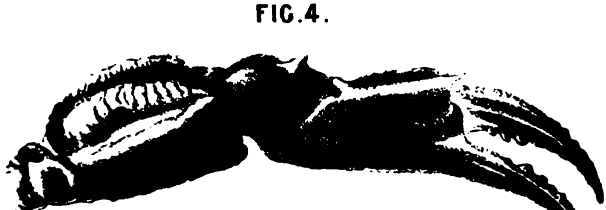
Lobster

FIG. 3

Xantho Florida.

FIG. 4.

FIG. 4.



Velvet Crab

FIG. 1.

Harbour Crab,
Carcinus Maenas
Exuvium.

FIG. 1.

Carcinus Maenas,
Common Harbour Crab.

The red line marks the separated portion, the blue lines the membranous hinge: as in the figure of the Clawleg of the Edible Crab.

FIG. 2.

Atelecyclus Heterodon.

FIG. 3.

Pilumnus Hirtellus.

larger figure—that of the common edible crab, the portion coloured red describes the border where the opening takes place, by the absorption of the crust. The blue lines are placed on those parts where, after the absorption of the crust, a membrane remains and forms the hinge; by the aid of which also, when the creature has escaped, the segments again close, and all appears as if it had never opened.

Since this Paper was presented to the society an opportunity has occurred of examining the exuviated hand-legs of the common harbour crab (*Carcinus Mænas*), and thus of placing beyond doubt the fact, that the flattened space in the inner division of the limb, as marked within the lines, is in this species also opened like the hinged cover of a box: although the exact disposition of the parts of the cover is somewhat varied from those of the edible crab some further enquiry will be necessary to ascertain the particular action of this process in some others of this family; as particularly, the *Galithææ*.

Observations on the Crystalline forms of Native Metals.

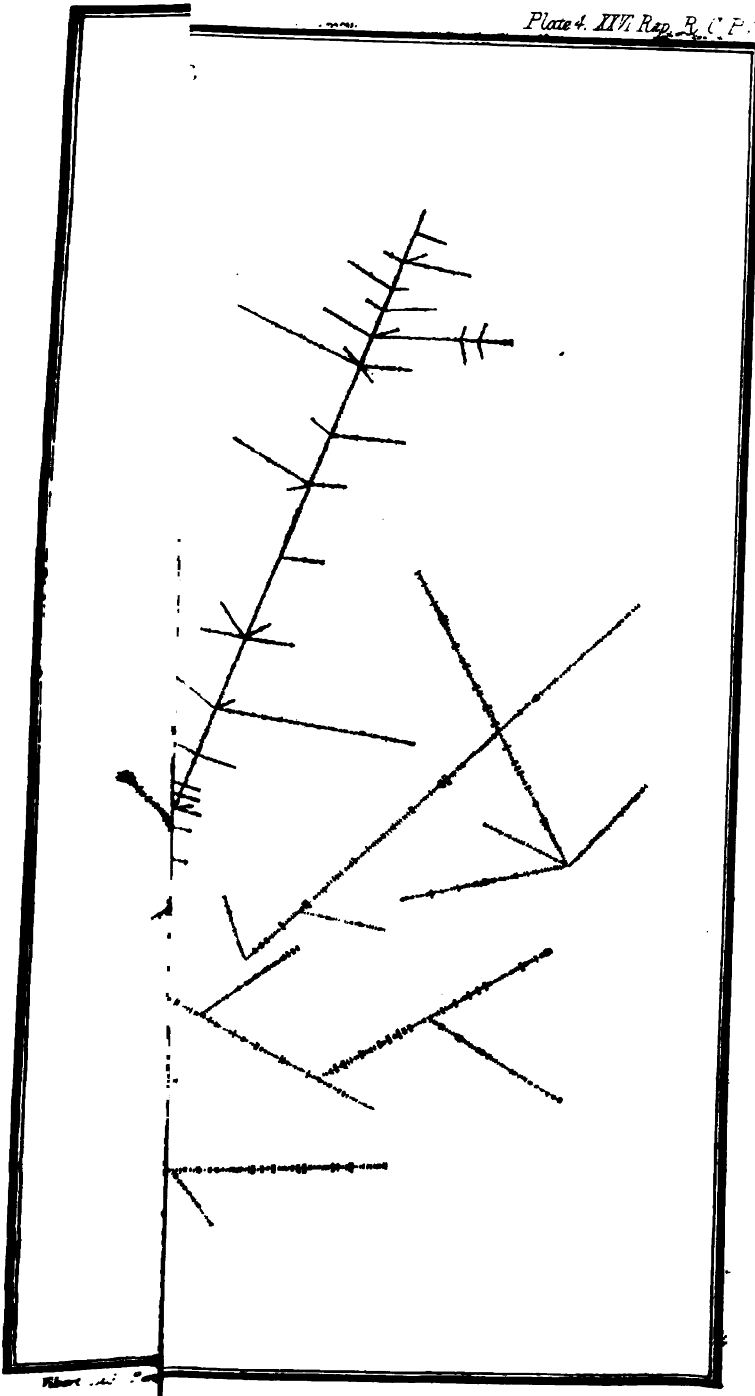
By Mr. W. VIVIAN.

The accompanying drawing (Plate IV.) is intended to illustrate a microscopical formation of native copper from Llanduduo mine, North Wales. Under a microscope its appearance is beautifully symmetrical: it is seen to stand erect in trunks like trees, each trunk sending out numerous branches; these, all self-supporting, are composed of separate, flat, octahedron crystals run out in their shortest axial lines, like beads on a string, or, where a little more clustered, like spikes of flowers. There does not seem to be any diminution of the crystallizing forces at the extremities; on the contrary, the branches are as large as the parent trunks, and there is often a finishing tuft at the extreme ends of these.

Believing that these symmetrical forms of native copper are rare, if not entirely unknown, I venture to suggest that this form may be considered the type of native copper crystallizations. Observations on the moss copper of our Cornish mines, induce the belief that these specimens are but aggregations of crystals where the symmetrical forms are overpowered and confused by the long continued and successive supply of copper in solution from masses of copper-ore. It appears also, by the dentritic and arborescent forms assumed by almost all metals when left free to crystallize in cavities, or on a soft gaugue, that the tendency of the crystals is to unite on the shortest axial lines, making it evident that the crystallizing forces develope peculiar affinities on these lines.

I was lately interested in observing in a specimen of rich oxide of copper taken from a mass of the skimmings of fluid metal from a refining furnace, a cavity, in which the symmetrical arborescent forms were beautifully developed, and very similar to the forms of native copper I have above described.

Plate 4. XIVI. Rep. R. C. P.



If the arborescent symmetrical forms are the true crystalline forms of all metals, whether found in masses in a state of fusion, or in native aggregations from solution, it is clear, that all the wiry and finely attenuated forms of gold and silver seen in the native state in specimens from veins do not exhibit the true characteristic forms of these metals, but are purely the result of accidental circumstances; that is, these latter forms are produced by mechanical causes, and may, perhaps, be accounted for in this way:—to produce the wire-form, globules and small masses in fusion, pressed by the contracting matter of the veins, were forced out through the small fissures with jets or wires and attenuated forms; gold and sometimes silver—native—show that the angles of the quartz and other hard matrix have been forced into the softer metal: as an illustration of these forms,—melting copper run off from the furnace into the sand-moulds, will, on cooling, contract, so as to force out numerous small jets or fibres of copper into the gas cavities and sand below.

The well known affinity or relationship existing between copper and oxygen is beautifully displayed on the crystallizations of native copper referred to; the spikes and branches of crystals are often dotted over with modified octahedrons of the red oxide of copper, showing the translucent ruby-red colour: the association is most intimate, and, I conceive, is illustrative of copper crystallization universally. I do not refer to the massive formation of native copper, such as are found in the Lake Superior mines, but to native copper *crystallizations*, such as those of our own mines A minute crystal of native copper often forms the nucleus, or germ, of a crystal of red oxide; or an internal thread of crystals of native copper is so surrounded by crystals of the ruby copper as to be entirely hidden from view: this fact may be known to close observers, and seems to intimate a change in the condition under which the crystallization took place. Probably, after the crystallizations of native copper were minutely formed, the solution became charged with an excess of oxygen; or there might have been an alteration of temperature, or some other change, yet unexplained, by which the affinities between copper and oxygen were stimulated and intensified to produce the ruby copper crystals. It is remarkable that, although there is a transition in the crystallization from that of metallic copper, to copper combined with oxygen, there is very little, if any, real change in the character of the crystals,—they remain the modified oxtahedron throughout; of course the angles and facets of the latter are the most perfect.

I have also found this relationship between metallic copper and the red oxide of copper crystallization existing in the copper precipitated from the water of mines. I now refer to the "precipitate" from the rocks of the celebrated Pary's mountain copper mines, Anglesey, which I have had frequent opportunities of observing. It seems to be the received opinion that all the copper thus precipitated is thrown down in the metallic state, but so far from this being the case, a large proportion, certainly more than one-half, is in the state of red oxide; even the richest specimens from the first cementation-pits show a considerable quantity of the oxide, and the inferior samples show nearly all the copper in this state.

Llandudno, September 18th, 1858.

Mines.	Engines, and diameter of cylinder. inches.	Horse power of the Engine.	Length of stroke in the cylinder.	Length of stroke in the shaft.	Period in months over which this account stands.	Average number of strokes per minute for the whole period.	Pressure of steam per sq. inch in boilers.	Load per sq. inch on the piston.	Cwts. of Coals consumed in the whole period.	Total number of millions of lbs. lifted one foot high during the whole period.	Duty: or millions of lbs. lifted 1 ft. high by consuming 1 cwt. of coals.	Remarks. Kind of Piston, &c.	Remarks. Machinery attached to the Engine, &c.	Remarks. Engineers' Names.
Alfred Consols........	Davey's 80	335	10·0	10·0	2	3·6	39	10·2	1772	127006	71·6	Spring piston.	....	S. Grose.
"	Field's 60	188	9·25	8·25	2			9·0	*	*	*	Packed piston.	100 fms. dry rods in the shaft.	"
Botallack	" 30	47	6·33	5·5	12	3·6		20·1	3745	157853	42·1	"	34 fms. do.	J. Rowe.
Cargoll Mines	" 70	256	9·75	9·75	12	5·1	34	14·0	24924	1383698	55·5	"	....	Hocking & Loam.
Carn Brea............	" 76	302	9·0	7·0	12	2·9	33	15·4	21720	874628	40·2	"	....	"
Dolcoath	" 76	302	9 0	7·5	12	5·6	32	14·0	34967	1686800	48·2	"	55 fm. dry rods underground.	"
East Basset	" 60	188	8·5	7·2	2		41	8·1				"	....	"
East Pool	" 60	188	9·75	7·75	12	3·9	48	12·8	16866	739597	43·8	"	....	J. West.
Great Work	Leed's, 60	188	9·0	7·0	12	7·9	50	16·5	22721	1573763	69·2	Packed spring piston.	....	P. Roberts.
"	Deer Park, 40	83	10·0	9·0	3	5·9		8·5	969	51167	52·8	"	....	"
North Pool	" 50	130	9·0	9·0	12	5·0	38	20·5	21172	982358	48·6	"	4 fms. flat rods.	Sims & Son.
North Roskear........	Doctor's, 70	256	10·0	8·0	12	5·8	41	14 2	27474	1628714	59·2	Packed piston.	....	J. West.
St. Aubyn & Grylls ...	" 40	83	9·0	7·5	12	4·5	30	14·5	6778	384415	56·7	"	....	S. Grose.
South Crenver	" 70	256	12·0	12·0	12	2·8		10·9	16995	744081	43·7	Packed spring piston.	75 fms. flat rods at surface, & 85 ,, dry rods underground.	Matthews and West.
South Wheal Frances..	Marriott's, 75	294	11.0	9·0	12	2·4	32	15·4	15430	946999	61·3	"	....	T. James.
Treloweth............	" 60	188	9·0	8·5	12	5·7	54	18·0	23405	1283072	54·8	Spring piston.	....	S. Grose.
Wheal Basset	" 40	83	8·33	6·66	3			13·6	†	†	†	Packed spring piston.	220 fms. dry rods	Sims & Son.
Wheal Kitty..........	" 33	57	6·0	6·0	12	3·2	36	12·7	5532	109559	19·8	Spring piston.	....	"
Wheal Margery	" 40	83	8·33	7·33	12	4·1	40	20·7	9728	507364	52·1	Packed piston.	....	G. Eustice.
West Whl. Providence.	" 50	130	11·0	9·0	12	8·0	44	17·2	22318	1241537	55·6	"	....	"
									275517	14422611	52·3	Average "duty" of the whole per 112 lbs. of Coals.		
											43·8	" " " 94 lbs. "		

* Counter idle. † Changing the Lifts.

STAMPING ENGINES.

There have been four reported, the *average maximum* duty being 52·4 millions per 112 lbs. of Coals.

Observations on Engine Reporting.

In connexion with the mining interests of the county there are few subjects of more importance than the economic performance of the steam-engines, and still fewer that have promoted the prosperity of the mines more than the various advances towards perfection which have from time to time been made in those machines,—having, according to the "Historical Statement of the duty performed by the steam engines of Cornwall, compiled at the request of the British Association in 1839," resulted at that time in an annual saving to the mines, in the matter of fuel alone, of nearly one hundred thousand pounds sterling—and that merely by the improvements made in the previous twenty-one years.

When, therefore, it is remembered that by the documents exhibited in that "Statement" these improvements are shown to have been *gradual*—being an average increase of "duty" performed of about nine millions of lbs. lifted one foot high by the consumption of 94 lbs. of coals in each of the septennial periods from 1814 to 1835, it becomes an important subject of enquiry whether the same progress has continued since the last period to the present time; but, on referring to the official monthly reports from 1838 to the past year, it appears that there has been no progress made in the duty performed in this second period of twenty one years. The question then naturally presents itself,—"Has the application of steam as applied to our machinery reached perfection? But here we are met by the startling fact, that in this very period there has been a decided detérioration, and that to a very considerable extent, as will be seen from the annexed abstract of the duty performed by the engines, inserted in "*Lean's Engine Reporter* for 1858, showing an average duty of 438 millions instead of about 52 or 53 performed twenty years since.

What has caused this change? Is the remark of the Editor of the Mining Journal true, that engine-houses, which were once the pride of all engaged, are now remarkable only for dirt and grease? or, has any cause intervened to check that friendly rivalry between the engineers of the county, to which may be attributed much of that remarkable progress prior to 1839? Has not the fact which presents itself, while examining these monthly records, some connexion with this decrease of duty? viz:—that in this period of twenty-one years there has been a gradual decrease in the number of engines officially reported, implying an apathy regarding the performance of the steam engines, which, viewed in connexion with the interest exhibited in the matter during the twenty-one years prior to 1838, is cause of surprise. May not much of the decrease of the duty be attributed, in a degree, to this apathy on the part of those connected with the management of our mines; thus shown in the discontinuance of the public reporting? That the mere reporting of the "duty" performed by the engines, by itself, causes any improvement, no one will for a moment maintain; but that it has and does stimulate all means of raising the credit of the Cornish engines, &c., above those of all England is a fact patent to all. Or, as Mr. Sims remarks in his letter to the Polytechnic Society, in September, 1857:—"Although the principle hitherto adopted for reporting has its imperfections, it has been the means of doing immense good to the mining interest of this county, and has been the chief means of raising the character of the Cornish engine above that of any other engines; and when we take into consideration the immense consumption of coal by the whole of the steam-engines in Cornwall, and the high price paid for it, it is important that means should, if possible, be adopted to make further improvements; or if nothing more than to cause engineers to take the greatest care of such engines as may be under their charge, and to raise a spirit of emulation amongst them, it would be of considerable benefit to the mining interest to adopt the same principle, with such improvements as may be necessary as have been the great cause of the improvement in steam power in this and other counties since the commencement of the Reports."

It becomes, therefore, matter for regret, that such an efficient prompter to improvement and watchfulness on the part of all those having the care of machines, involving so great an annual expenditure, should have been allowed to become so comparatively discontinued, as appears from Lean's Engine Reporter for 1858, which contains only twenty engines, or less than one-third the number reported in 1839; about which time the maximum duty was performed.

Contributions to the Falmouth Fauna, 1858.

Grasshoppers, &c., found in Falmouth and neighbourhood.

By. W. P. COCKS, Esq.

"Insects generally answer the most beneficial ends, and promote in various ways, and in an extraordinary degree, the welfare of man and animals. The evils resulting from them occur partially when they abound beyond their natural limits. God permitting this occasionally to take place, not merely with punitive views, but also to show us what mighty effects he can produce by instruments seemingly the most insignificant: thus calling upon us to glorify his power, wisdom, and goodness, so evidently manifested, whether he relaxes or draws tight the reins by which he guides insects in their course, and regulates their progress; and more particularly to acknowledge his overruling providence so conspicuously exhibited by his measuring them, as it were, and weighing them, and taking them out, so that their numbers, forces and powers, being annually proportioned to the work he has perscribed to them, they may neither exceed his purpose, nor fall short of it."

Kirby and Spence.

"Not to know at large of things remote
From me, obscure and subtile, but to know
That which before us lies in daily life,
Is the prime wisdom; which is more in fume,
Or emptiness, or fond impertinence,
And renders us, in things that most concern,
Unpractised, unprepared, and still to seek."

Milton.

Phasgonura viridissima, Westwood. Castle hill, Pennance, &c.

"So chirps the grasshopper one good-night carol more;
He is an evening reveller, who makes
His life an infancy, and sings his fill."

Childe Harold.

"Green little vaulter in the sunny grass,
Catching your heart up at the feel of June,
Sole voice that's heard amidst the lazy noon,
When even the bees lag at the summoning brass."

Leigh Hunt.

Baron Walckenear, has considered it probable that this was the *Gaza* in the Chaldean version of the prophets Joel and Amos.

The wing-covers of the males are furnished at the base, near the suture, with a round talc-like plate, surrounded by strong ridge-like veins, one on the underside, towards the internal angle of the left hand wing-cover, being stronger than the rest, and serving as a bar to produce the sound upon rubbing the two wing-covers sharply over each other.

The object of the stridulation of these insects is, the calling of the female."—*Westwood.*

Decticus verruciverorus, Serville. A specimen, 1⅜ in. in length, was captured by Mr. White, Marsh, Gwyllyn-vase sands:—specimens were also procured in the "Marsh-meadow," near Roscrow, Mainporth beach.

This insect is employed by the Swedish peasants to bite the warts on their hands; the black fluid which it emits from the mouth being supposed to possess the power of making these excrescences vanish.

Locusta migratoria, Leach. Elytra clouded with pale yellow and brown; antennæ short, yellowish-brown; head obtuse, brownish-green, glossy, punctured with a line along the middle of forehead,—two others, one on each side; mandibles blackish; thorax brownish-green, carinated, with two dorsal lines and a black spot on each side; wings transparent, tinged with brownish-green at base; abdomen testaceous; thighs angular, spotted with brown on their external aspect; tibiæ pale flesh-colour, with two rows of long and sharp-pointed spines; length 2⅜ inches.

"It is armed with two pairs of very strong jaws, the upper terminating in short and the lower in long teeth, by which it can both lacerate and grind its food, its stomach is of extraordinary capacity and power."—*Kirby*

Sir W. Ouseley, in his travels in Persia, says, that certain extraordinary words were supposed to be inscribed on the wings of locusts. *The Gieur de Beauplan* heard from persons well skilled in various languages, that the characters were Chaldaic, and form *Boze Guion*, words signifying "the Scourge of God."

But the Musselman writers say the characters are Arabic.

"We are the army of the living GOD; we have ninety and nine eggs, and had we but the hundredth, we would consume the world and all that it contains."

One was captured alive by Mr. W. May, of Bunny Hall Cottage, Gwyllyn-vase, September 28th, 1846, near the residence of the Rev. W. J. Coope, Bar-lane. A second specimen was procured by Mr. Bell, Jun. (and given to Master Dash), at Gwennap, September 27th, 1857; it was exhibited alive at the annual meeting of the Royal Cornwall Polytechnic Society on the following day.

MIGRATORY LOCUST.

Locust, Arbeh (Heb.); probably from the root *rabah*, to multiply.
Bochart.

"Onward they come a dark continuous cloud,
Of congregated myriads numberless,
The rushing of whose wings is as the sound
Of a broad river headlong in its course
Plunged from a mountain summit, or the roar
Of a wild ocean in the autumn storm,
Shattering its billows on a shore of rocks."
Southey.

"These infinite armies of Locusts, which, when they have laid bare our country, as an overshadowing and dark cloud pregnant with the wrath of heaven, pass on to another; mighty conquerors of old, of whom they were the symbols, from Sesostris to Senacherib and Nebuchadnezzar, also mark their progress by devastation and ruin."—*Rev. Mr. Kerby.*

"Locusts of the desert", says *Denon*, "pass through the country and ravage like a wasting torrent. I cannot tell whether in a season wherein they find pasture they are more settled; but in the dry season when we were there, they had the inquietude and insatiability of hunger which finds nothing to satisfy it."

"I am tossed up and down as the locust."—*Psalms.*

Mr. Westwood observes,—"It is certain that numerous species have been confounded together under the name of *Locusta* *migratoria;* the true *Locusta migratoria* is the species which occurs in central Europe, but the species which devastate the East, Arabia, Barbary, &c., are doubtless distinct."

The earliest plague of locusts which has been recorded was in Egypt, B.C., 1491. Moses said unto Pharoah, "Thus saith the Lord God of the Hebrews, How long wilt thou refuse to humble thyself before me? Let my people go, that they may serve me. Else, if thou refuse to let my people go, behold, to morrow will I bring the locusts into thy coast: And they shall cover the face of the earth, that one cannot be able to see the earth: and they shall eat the residue of that which is escaped, which remaineth unto you from the hail, and shall eat every tree which groweth for you out of the field: And they shall fill thy houses, and the houses of all thy servants, and the houses of all the Egyptians; which neither thy fathers, nor thy fathers' fathers have seen, since the day that they were upon the earth unto this day."

And at the present day these insects infest not only Egypt, but all the neighbouring countries, appearing in greater or less numbers almost every year: their desolating effects upon vegetation, and consequent injury both to man and beast, have afforded a frequent exercise to the poet, historian, &c.; but no pen has so beautifully depicted their ravages as that of the Prophet Joel, B.C., 800. "A day of darkness and of gloominess, a day of clouds and of thick darkness, as the morning spread upon the mountains: a great people and a strong: there hath not been ever the like neither shall be any more after it, even to the years of many generations. A fire devoureth before them, and behind them a flame burneth: *the land is as the garden of Eden before them, and behind them a desolate wilderness; yea, and nothing shall escape them.* The appearance of them is as the appearance of horses; and as horsemen, so shall they run. Like the noise of chariots on the tops of mountains shall they leap, like the noise of a flame of fire that devoureth the stubble, as a strong people set in battle array. —— The earth shall quake before them; the heavens shall tremble: the sun and the moon shall be dark, and the stars shall withdraw their shining." "How do the beasts groan! the herds of cattle are perplexed, because they have no pasture; yea, the flocks of sheep are made desolate." Their destruction is also noticed by the prophet. "I will remove far off from you the northern *army*, and will drive him into a land barren and desolate with his face toward the east sea, and his hinder part toward the utmost sea; and his stink shall come up, because he hath done great things."

Lightfoot, in his *Travels in Africa*, says, "I never saw such an exhibition of the helplessness of man as I have seen to day. While we were sitting at dinner, a person came into the house, quite pale, and told us that the locusts were coming. Every face gathered darkness; I went to the door—I looked above, and all round, and saw nothing. 'Look to the ground,' was the reply, when I asked where they were. I looked to the ground, and there I saw a stream of young locusts without wings, covering the ground at the entrance of the village. The stream was about five hundred feet broad, and covering the ground, and moving at the rate of two miles an hour; In a few minutes they covered the garden wall, some inches deep, and the water was immediately let into the channel, into which it flows to water the garden. They swim with the greatest ease over standing water, but the stream carried them away, and after floating in it about a hundred paces, they were drowned."

"All hands were now at work to keep them from the gardens and to keep them from crossing the stream. To examine the phenomenon more clearly, I walked about a mile and a half from the village, following the course of the stream. Here I found the stream extending a mile in breadth, and like a thousand rivulets all flowing into one common channel. Such a scene as I have witnessed this afternoon would fill England with more consternation than the terrific cholera. One of the people here informed us that he had seen a stream that continued ten days and nights flowing upon his place.

"During that time every person in the place was at work to preserve his garden; as to the corn fields they were obliged to give them up. They continued to the fifth day defending their gardens; on the evening of the fifth, the locusts were between five and ten feet deep, and the mass by this time became terrible and literally fell in pieces over the garden wall."

Capt. Beaufort told Capt. Hall, that when at Smyrna, in 1811, he had an opportunity of forming a rude estimate of the locusts, then drifting from south to north.

"The Consul's messenger to Sardis rode 40 miles before he got clear of the moving column. It was inferred, from observations made with a pocket telescope, that the height of the column could not be less than 300 yards; and the rate of its passing was not slower than seven miles an hour.

"This continued for three days and nights, apparently without intermission. As these insects succeeded one another at an average distance of not more than three inches, and were about one foot apart above one another, it was computed that their lowest number in this enormous swarm must have exceeded 168,698,563,200,000, or, English numeration, 168 billions, 698 thousand 563 millions, 200,000 locusts."—*Hall's Frag.* 2nd Ser.

An old Arabian fable is,—"they are directed in their flight by a leader or king."

Bullivant, in the Philosophical Transactions, states, that "the locusts have a kind of regimental discipline, and as it were some commanders, which show greater and more splended wings than the common ones, and arise first when pursued by the fowls or the feet of the traveller, as I have often seriously remarked."

Jackson, in his *History of Morocco*, observes, that "they have a government amongst themselves similar to that of the bees and ants; and when the *Sultan Ierraad* or *king* of the locusts rises into the air the whole body follow him, and in their course they proceed as regularly as a disciplined army on its march, nor is a single one left behind."

"A vast swarm of grasshoppers which have been devastating the prairies of Texas steered a north-east course upon their departure thence, and as they arose to a great height from the ground, as though for a long journey, it is a melancholy conclusion that they are coming up this way. Myriads of them are now eating up vegetation in *Ohio*. It is therefore, no very violent supposition that Pensylvania, with rather a milder climate than *Iowa*, is not unlikely to be visited by them. These insects are not like the common grasshoppers, which are every summer found in our fields and roads, but are of the size of a locust, with the same gregarious habits. The ordinary grasshopper is weak of wing, and never rises to a great height, whereas the legions which have so repeatedly desolated *Utah* and *Texas* rise far into the upper air, and move off together to great distances like wild geese. They appear in innumerable hosts, and instead of scattering, alight in a body upon some devoted locality, which they attack and destroy with the systematic movement of an army. They will thus eat up a crop of corn or cotton in a very short time. In *Utah* this plague visited the growing cereals with utter destruction, as often as three times in one season, so that the afflicted Mormons were reduced to extremities for food. They seem now to have attacked our frontier states, and to be moving gradually into the body of the Republic. The horrors of famine have never been felt in our country, and accustomed to the most prolific abundance, it is a calamity to which no one has ever looked; yet these grasshoppers are a terrible visitation."—*Philadelphia American*, June, 1858.

"They will entirely eat up a field of corn in a single night. The people in some parts of Ethiopia destroy the ground not only for the time, but burn trees for two years after; so that they are forced to sell themselves and children for sustenance." *Io. dos Sanctos.*

"Swarms of locusts have appeared in several of the Phillipine Islands, and have caused immense damage to the plantations. Public prayers have been offered up, and the common people are employed in the fields in collecting and destroying them, the authorities paying so much for every basketful presented to the Alcaldes. It does not appear that the natives of the Phillipine Islands eat the locusts, as the Riff Arabs do. The latter, when they see a cloud of locusts hovering in the air and clouding the sky, watch them anxiously, and if they descend near their *adwars* receive them with shouts of gratitude to GOD, and Mahomet, throw themselves on the ground, and collect them as fast as possible. Previously deprived of their heads, legs, and wings, the locusts, well boiled in butter and served up with *alcuzcuz*, are considered by the Riff Arabs as delicious food."—*Lady's Newspaper*, Oct. 23rd, 1858.

"A swarm of locusts recently settled near Retford, and the rooks for miles around made a great feast of them."—*News of the World*, June 19th, 1859.

Burmese dainties. "After the king had disappeared refreshments were brought in, of which we partook:—but the most notable viand produced consisted of fried locusts. These were brought in hot-and-hot in successive saucers, and I was not sorry to have the opportunity of tasting a dish so famous. They were by no means bad, much like what we might suppose fried shrimps to be."—*Mission to Ava.*

Dr. Livingstone observes. "these locusts are quite a blessing to the country; so much so, that the rain doctors sometimes promised to bring them by their incantations. The locusts are strongly vegetable in taste, the flavour varying with the plants on which they feed. There is a physiological reason why locusts and honey should be eaten together. Some are roasted and pounded into meal, which eaten with a little salt is palatable; it will keep thus for months. Boiled they are disagreeable; but when they are roasted, I should much prefer locusts to shrimps, though I would avoid both if possible."—*Researches in South Africa*, 1857.

The Arabs gave us a reason for their feeding on the locusts, that the insects themselves feed on the best vegetables, and even on those of medical virtues, whose good qualities they may be supposed to imbibe.

John the Baptist retired into a desert, where he lived on locust (?) and wild honey.

Porhgry (a famous platonic philosopher, born at Tyre in 233, in the reign of Alexander Severus, and died in the reign of Dioclesian) observes, that "an army in Africa, ready to perish by famine, was seasonably relieved by a cloud of locusts, on which they fed."

"Immense quantities of locusts in their migration are devoured by birds, pigs, lizards, frogs, &c. It is stated that the locust-eating Thrush (*Turdus selecus*, Forskal, *T. gryllivorus*, Linn.), called by the Arabs *Samarman* or *Samormog*, comes from Arabia annually in pursuit of the locusts, and destroy 10,000 daily. This bird is protected, either by a public edict of the Turks, or by a precept of the Koran. The ibis, says Sir I. G. Wilkinson, was of great use in Egypt in destroying locusts, &c. They affirm, that in the commencement of every spring these winged serpents (locusts) fly from Arabia towards Egypt, but that the ibis here meets and destroys them. The Arabians say, that in acknowledgement of this service the Egyptians hold the ibis in great reverence (*Herodotus*). In the neighbourhood of Odessa, myriads of a peculiar fly of that kind called ichneumon, may be met with, employed in killing and burying the locust. The manner in which this is done is very singular. These flies steal upon the locusts unawares, mount upon their back, and strongly apply their own long powerful legs around the body of the locust, so that it cannot spread its wings and mount into the air, whereby it might escape. When the locust is wearied with exertions to get free from the gripe of his enemy, the fly applies the strong nippers, with which the mouth is furnished, to the neck of the locust, then pushes its sharp dart between the victim's head and body, and in a few seconds the locust is dead. The fly remains for some time attached to the body of the locust; but whether this is for the purpose of lodging its eggs in the body, is not yet known. Before the fly goes in search of a locust for destruction, it prepares a small hole in the ground, which it does very quickly, by means of its nippers and legs; in this hole it drags the body, and afterwards scrapes the earth over it; and to render the surface smooth, it seems to take great pains in replacing the earth, by running backward and forward over the spot, whilst patting it with its legs."—*Travels through the Crimea and Turkey*, by *W. Webster*.

In the south of France, men are employed to discover the eggs of the locusts, about September and October; and in the month of March, troops of hogs are turned into the grounds that are suspected of concealing them; these animals, by turning up the ground with their snouts in search of a food which they are fond of, destroy vast quantities. The labour of hunting these insects should be begun at night and morning when the air is loaded with vapour, or the temperature low, being at those times sluggish and easily destroyed. The Turks send out bodies of peasants to destroy the locusts.

"Thy crowned are like the locusts, and thy captains as the great grasshoppers, which camp in the hedges in the cold day, but when the sun ariseth they flee away, and their place is not known where they are."—*Nahum*, III. 17.

By the law in *Cyrenaica* (Africa,—it was considered by the Greeks a sort of terrestrial paradise), the inhabitants were obliged to destroy the locusts in different states, three times a year *(Pliny)*. A similar law was enacted in Lemnos (an island in the Ægean sea), by which every one was compelled to bring a certain measure of locusts annually to the magistrates.

From a curious Chinese document, published in the Royal Asiatic Society's Transactions, it appears to be a part of the duty of the provincial governors to see to the destruction of these obnoxious insects, and to erect stations for giving rewards for them.

In 1813 the French Government issued a decree with a view to occasion the destruction of grasshoppers. Orders were given at the last appearance of locusts in Transylvania, in the year 1828, not to disturb them in their flight; but to let them alight in large masses, and only then employ suitable means for their distruction. If locusts have settled in a district a number of people must be collected in proportion to the size of the space of ground they occupy. These people are either to surround the whole ground covered by these insects; or if they are not enough for this purpose, one part after another, and kill the locusts with bundles of twigs and brooms, continually narrowing the circle. The dead locusts must then be collected with rakes, or old brooms, and either burnt or buried in deep holes and covered with unslacked lime; this labour must be begun if possible immediately after the arrival of these insects, while they are fatigued with their flight; or at night and morning when their wings are wet with dew, and in rainy weather, otherwise they would rise and fly away. In the south of Europe rewards are offered for the collection both of the eggs and perfect insect, half a franc being paid for a kilogramme (equal to 2 lbs. 3 oz. 5 drs. avoirdupois) of the former, and a quarter of a franc for the same measure of the latter. The city of Marseilles paid, in 1613,—25,000 francs, in 1824, 5,542, and in 1825, 6,200 francs.

On the figurative application of the Locust.

To this insect the preacher compares "a dry, shrunk, shrivelled, crumpling, craggy, old man, his back-bone sticking out, his knees projecting forward, his arms backwards, his head downwards, and the apophyses, or bunching parts of the bones, in general enlarged." *Dr. Smith* says, "without all doubt, arose the fable of *Tithonus*, who, living to extreme old age, was at last turned into a grasshopper. Tithonus, a son of Laomedon, king of Troy, by Strymo, the daughter of the Scamander. He was so beautiful that Aurora became enamoured of him, and carried him away. He begged of Aurora to be immortal, and the goddess granted it; but as he had forgotten to ask the vigour, youth, and beauty which he then enjoyed, he soon grew old, infirm, and decrepid; and as life became insupportable to him he prayed Aurora to remove him from the world. As he could not die, the goddess changed him into a grasshopper."

"And there came out of the smoke locusts upon the earth: and unto them was given power, as the scorpions of the earth have power."—*Revelations*, IX. 3, 4.

Locusta flavipes, Gmelin. Meadows, Budock Bottom, College wood, &c.

—— *elegans*, Charp. Marsh, Gwyllyn-vase, on the lower portion of the *Eleacharis palustris*.

Locusta dorsata, Step. Meadows near Budock Bottom, and Rosmerian.

—— *viridula*, „ Fields, Penwerris, &c.

—— *biguttula*, „ Ashfield Meadow, &c.

—— *mollis*, „ Meadows, Trescobease, Penmere, &c.

Gromphocerus, biguttatus, Step. Pennance heath, Castle-slope, south, &c.

Acrydium bipunctatum, Steph. Pennance, Mainporth, &c.

Gryllotalpa vulgaris, Step. Two found by Mr. Rasleigh in hot-bed refuse, from Marlborough Cottage, Swanpool. Specimens have been found by other gardeners in the neighbourhood; it is said they do much mischief in gardens and plantations by injuring the roots of plants.

Rosel asserts that the mole cricket is capable of pushing forward a weight of six pounds with his fore feet on an even surface, by which we may make a calculation of the power with which it can remove the soil in digging its passages. Their presence is discovered by their throwing up the earth like moles.

Acheta domestica, Curt. A regular pest in the kitchen, &c.

> "Far from all resort of mirth,
> Save the cricket on the hearth."
> *Milton.*

> "And you, warm little housekeeper, who class
> With those who think the candles come too soon,
> Loving the fire, and with your tricksome tune,
> Nick the glad silent moments as they pass."
> *Leigh Hunt.*

Sir W. Jardine says, that in Dumfrieshire, "it is considered lucky to have crickets in a house; but if they disappear from one which they have long inhabited, it is looked upon as foreboding some calamity to the family."

Blatta orientalis, Linn. In the kitchen a perfect nuisance. Voracious insects running with great activity and devouring everything they can find, flour, bread, meat, cloths, books, shoes, &c. They likewise pollute everthing they crawl over with an unpleasant nauseous smell.

Ectobius Penzeri, Step. Found under the bark of an old apple tree, Green-Bank, &c.

ADDENDA.

Totanus fuscus, Flem. (immature plumage), was purchased in the Falmouth market, December 3rd, 1859. Shot by James Clift on Gonhilly downs.

—— *ochropus*, Temm. Shot near the pool, Swanpool,

Squalus maximas, Linn. Taken in a net belonging to one of the driving boats, August, 1858. It weighed upwards of 3 cwt., and measured 8 ft. in length.

Serranus gigas, Cuv. et Valenc. Was purchased by Dr. Vigurs, in the Falmouth fish-market, September 14th, 1858. A second specimen (very large) of this rare fish was procured by the Doctor in the same month.

Mullus barbatus, Linn. Two fine specimens purchased by Capt. Bently, Oct. 12th, 1858.

Cyclopterus lumpus, Cuv. A male, in fine condition, was brought to my residence by a fisherman.

Turdus aurigaster, Vielot. A very rare African bird, the skin of one of which was recently found at Falmouth, in an old box with other foreign skins that had not been opened for some years. In the possession of Dr. W. K. Bullmore; mounted by Mr. Philip Chapman, taxidermist.

Laurus glaucus, Brunn. On the flats, extreme low-water, too shy to allow an approach, February, 1859,

Monochirus lingnatulus, Cuv. Fish-market, March, 1859.

Stylifer Turtoni, Brodrip. Two specimens alive of this rare shell, found in trawl refuse, by Miss Vigurs, March, 1859.

Mullus Surmuletus, Linn. Plentiful, 1858. "Surmullet have been more plentiful than we have ever known, and sold at very low prices, the small ones at six for a penny. Large quantities have been caught in the Penryn river, in nets, during the last few days."—*Falmouth Packet*, August 14th, 1858.

Tringa pugnax, Linn. Male and female.*

Sylvia Sibilatrix, Selby.*

Upupa epops, Linn.*

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* The breast bones, partially covered with flesh, of these birds were sent to me early in the spring of the year (1859), by W. P. Chapman.

The spawn of the *Sepiola atlantica*, D'Orbig. Found attached to a specimen of the *Gorgonia verrucosa*, Cole (dredged near the Lizard), by Miss Vigurs.

Spawn of the *Cypræa Europæa*, Linn. Found by Miss Vigurs.

Chemnitza semi-striata, Cocks. Shell elongated, awl-shaped, slender; nine flat whorles divided by a deep suture; ribs rounded, extending to about one half of the depth of each whorle, truncated; intervening sulie deep; lower portion of each whorle smooth and free from marking: aperture sub-ovate, angulated superiorly, rounded inferiorly; colour dirty opaque white; length 3-16ths of an inch. Found in grey sand dredged up near Trefusis Point.

REGISTER OF DREDGING OPERATIONS PERFORMED BY 1859.

Locality.	Distance from the shore.	Depth.	Sea-bottom.	Animals, plants, &c.	Date.
Falmouth Harbour.	¼ of a mile from Black rock.	6 fathoms.	Muddy	*Zoster marin.*, *Bullæ hydat.*, *Pag. Bernhardus*, &c.	May 10th.
Gwyllyn-vase Bay.	1,000 ft. from low-water mark.	4½ fathoms.	Sand, pebbles, &c.	*Tell. pygm.*, *T. crass.*, *Card. min.*, *Tap. Virgin.*, *Riss. cons.*, det., rub., &c.	June 27th.
Swanpool..........	1,800 ft. from low-water mark.	5 fathoms.	Gravelly, weedy, &c.	*Pisa Gibsii*, *Portunus puber.*, *Pirionela dent.*, &c.	July 7th.

TABLE No. I

Meteorological Summary af the Weather at Helston, in Lat. 50° 7' N., Long. 5° 18' W., for the year 1858. from Registers kept by M. P. Moyle Esq.

1858. MONTHLY MEANS OF BAROMETER. Cistern 106 feet above mean sea level.

Month.	Mean pressure corrected to 32° Fahr. 9 a.m.	3 p.m.	9 p.m.	Mean of monthly means.	Mean correction for diurnal range.	True mean of monthly means.	Mean force of vapour.	Mean pressure of dry air.	Mean range of means.	Mean daily range.	Corrected absolute maximum observed.	Day.	Corrected absolute minimum observed.	Day.	Extreme range for the month.	Greatest range from 9 a.m. to 9 p.m.	Day.	Greatest range in any two consecutive 24 hours.	Between which days it occurred.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.		in.		in.	in.		in.	
Jan.	30·282	30·261	30·277	30·273	0·004	30·269	·295	29·974	·113	·071	30·610	17	29·755	26	·855	·312	11	+ ·406	10& 11
Feb.	29·815	29·798	29·818	29·810	3	29·806	·263	29·544	·132	·078	30·154	25	29·444	22	·710	·296	4	— ·520	1 & 2
March ..	29·908	29·893	29·909	29·903	7	29·896	·284	29·612	·155	·096	30·446	22	29·056	31	1·390	·241	11	— ·757	12 & 13
April ...	29·835	29·825	29·833	29·831	4	29·827	·338	29·489	·149	·107	30·263	22	29·115	30	1·158	·429	1	+ ·714	31 & 1
May	29·881	29·900	29·926	29·902	2	29·900	·336	29·564	·147	·088	30·432	26	29·227	15	1·205	·331	3	+ ·744	24 & 25
June ...	30·036	30·043	30·057	30·045	1	30·044	·437	29·607	·083	·058	30·348	22	29·770	14	·578	·142	7	+ ·291	3 & 4
July	29·919	29·925	29·929	29·925	2	29·922	·445	29·477	·124	·075	30·182	4	29·442	27	·740	·184	4	— ·516	26 & 27
August..	29·957	29·961	29·961	29·959	4	29·955	·458	29·497	·089	·058	30·290	7	29·500	17	·790	·150	16	— ·381	16 & 17
Sept.....	29·926	29·922	29·935	29·928	4	29·924	·467	29·457	·145	·105	30·522	25	29·331	23	1.291	·488	23	+ ·860	23 & 24
October .	29·913	29·917	29·928	29·919	6	29·914	·344	29·569	·147	·079	30·479	30	29·329	10	1·150	·188	9	— ·589	6 & 7
Nov.	29·756	29·729	29·739	22·740	4	29·736	·289	29·447	·154	·079	30·389	7	28·876	27	1·513	·338	12	— ·587	12 &13
Dec.	29·873	29·867	29·893	29·878	3	29·875	·306	29·569	·143	·101	30·259	6	29·212	23	1·047	·519	23	— ·660	22 & 23
Means	29·925	29·920	29·934	29·926	4	29·922	·355	29·567	·132	·083	30·364		29·338		1·035	·301		·585	

Remarks.—0·121 in. should be added to all the readings of the Barometer for its elevation of 106 feet above mean sea level. The Barometer is a standard, having a bore of 0·6 in. diameter, with glass cistern 3 ins. in diameter, whereby the ivory point of the brass scale can, by sight, be brought to a tangent with the surface of the mercury at each observation; the open end of the tube has a ring of platina, as recommended by Daniell, for the perfect exclusion of atmospheric air—the tube was filled in vacuo with mercury of the specific gravity of 13·5,—and Mr. Glaisher's corrections have been applied to every period of observation, as taken from the Philosophical Transactions, part 1, for 1848.

TABLE No. 2.

MONTHLY MEANS OF THE THERMOMETERS.

1858 Mo.	Dry and Wet Bulb Thermometers. 9 A.M. Dry	9 A.M. Wet	3 P.M. Dry	3 P.M. Wet	9 P.M. Dry	9 P.M. Wet	Mean of dry Therm.	Correction for diurnal range	True mean of dry Therm.	Mean of Wet Therm.	Correction for diurnal range	True mn. tem. of evaporation	Wet Therm. below dry	Mean Dew point	Dew pt. below dry Therm.	Greatest range of dry Therm. from 9 a.m. to 9 p.m.	Registering Thermometers. Mean of all the maxima	Mean of all the minima	Approximate mean temp.	Correction for the month	True mean temperature	Mean range	Maximum observed	Day	Minimum observed	Day	Mean	Range
	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o		o		o	o
Jan.	46·6	44·9	48·6	46·2	45·7	44·0	46·9	0·4	46·5	45·0	0·1	44·9	1·6	43·1	3·4	10·0	51·8	40·8	46·3	0·2	46·1	11·0	50·0	8	38·0	5	44·0	12·0
Feb.	43·9	42·2	46·7	44·2	43·2	41·5	44·6	·6	44·0	42·6	·4	42·2	1·8	39·8	4·2	9·0	49·4	39·9	44·6	·4	44·2	8·2	58·0	6	29·0	25	43·5	29·
Mar.	47·0	44·8	49·7	46·4	44·7	43·3	47·1	1·2	45·9	44·8	·7	44·1	1·8	42·1	3·8	10·0	53·4	40·7	47·0	1·0	46·0	12·7	65·0	24	32·0	1 & 2	48·5	33·
April	53·1	50·1	55·9	52·5	50·4	48·8	53·1	2·2	50·9	50·4	1·4	49·0	1·9	47·1	3·8	17·0	60·4	46·0	53·2	1·5	51·7	14·0	75·0	22	35·0	11	55·0	40·
May	55·3	52·1	58·5	53·9	53·0	50·5	55·6	2·3	53·3	52·2	2·1	50·1	3·2	46·9	6·4	13·0	63·8	48·5	56·1	1·7	54·4	15·9	76·0	30	39·0	2	57·5	37·
June	65·7	60·6	68·6	61·7	61·6	57·9	65·3	3·0	62·3	60·0	2·0	58·0	4·3	54·6	7·7	12·0	73·9	53·8	63·8	1·8	62·0	16·8	88·0	23	46·0	5 & 7	67·0	42·
July	63·4	58·8	66·4	60·9	60·8	58·1	63·5	2·2	61·3	59·2	1·3	57·9	3·4	55·2	6·1	10·0	70·8	54·3	62·6	1·9	60·7	16·5	79·0	31	49·0	3	64·0	30·
Aug.	65·0	60·5	67·5	61·7	62·1	59·2	64·9	2·1	62·8	60·4	1·4	59·0	3·8	56·0	6·8	11·0	72·1	55·2	63·6	1·7	61·9	16·9	83·0	10	50·0	often	66·5	33·
Sept.	63·2	60·4	65·0	61·1	60·6	58·4	63·0	1·7	61·3	59·9	1·2	58·7	2·6	56·6	4·7	9·0	67·9	55·5	61·7	1·3	60·4	12·4	79·0	14	47·0	30	63·0	32·
Oct.	55·4	52·9	57·4	54·2	52·9	51·0	55·2	·8	54·4	52·7	·7	52·0	2·4	47·6	4·8	11·0	60·7	48·1	54·4	1·0	53·4	12·7	67·0	2 & 3	37·0	30	57·0	30·
Nov.	47·9	45·6	49·8	47·0	46·7	44·6	48·1	·5	47·6	45·7	·5	45·2	2·4	42·6	5·0	9·0	53·3	43·3	48·3	·4	47·9	10·0	59·0	26	32·0	18	45·5	27·
Dec.	48·0	46·2	49·9	47·5	47·4	45·6	48·4	·2	48·2	46·3	·1	46·2	2·0	44·2	4·0	10·0	53·7	43·4	48·4	·0	48·4	10·0	58·0	4	35·0	7	44·5	23·
Means	54·5	51·6	56·9	53·1	52·4	50·3	54·6	1·4	53·2	51·6	1·0	50·6	2·6	47·9	5·1	10·8	60·9	47·5	54·2	1·1	53·1	13·1	69·7		39·1		54·5	30.7

Remarks :—The Registering Thermometers are on Rutherford's principle and perfectly accurate. The Dry and Wet bulb Thermometers were made by myself with every care, and are found to be coincident, very nearly, with a standard Thermometer; where there has been any discrepancy the difference has been correctly noticed and allowed for.

TABLE NO. 3.

1868. MONTH.	WINDS. E.			S.E.			S.			S.W.			W.			N.W.			N.			N.E.			AVERAGE FORCE.				RELATIVE PROPORTION.			
	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	Mean	N.	E.	S.	W.
January .	3	1	3	4	6	2	5	5	6	4	5	6	4	4	3	5	4	6	3	4	3	3	2	2	2·0	2·1	1·6	1·9	21	17	29	26
February	10	11	10	4	4	4	3	2	2	3	2	3	0	1	1	1	3	3	1	0	0	6	5	5	2·3	2·4	2·0	2·2	12	45	17	10
March ..	6	7	7	1	0	1	3	2	2	3	4	2	4	6	7	6	5	6	2	4	2	6	3	4	2·2	2·4	1·6	2·1	22	28	13	30
April...	6	7	7	3	4	2	5	3	5	2	8	4	5	0	2	3	4	5	1	3	4	5	1	1	2·3	2·3	1·7	2·1	17	28	25	20
May	5	2	4	0	0	0	3	2	0	11	14	11	2	2	2	6	7	9	2	2	4	2	2	1	2·2	2·2	1·4	1·9	22	13	23	35
June....	1	2	1	3	2	2	4	5	6	4	6	4	1	2	2	12	9	12	3	3	3	2	1	0	1·6	1·9	0·9	1·4	27	9	26	28
July	1	1	2	2	1	0	1	2	3	10	12	8	2	2	4	11	8	8	3	4	5	1	1	1	1·8	2·2	1·3	1·8	27	7	23	36
Aug.....	4	5	1	1	0	0	3	3	3	3	2	2	4	7	6	13	9	10	3	5	7	0	0	2	2·0	2·4	1·0	1·8	32	12	13	36
Sept.. ..	9	9	9	3	3	1	1	2	2	8	7	7	4	2	4	4	5	5	1	2	2	0	0	0	2·0	2·4	1·6	2·0	12	30	20	28
Oct.	11	11	10	1	0	0	2	2	3	3	6	3	8	4	7	3	6	5	0	0	0	2	2	2	1·9	2·2	1·6	1·8	10	37	15	31
Nov.	10	10	9	6	6	5	3	2	3	1	2	3	2	1	0	0	1	1	1	2	3	7	6	5	2·4	2·6	2·3	2·4	16	47	20	7
Dec.	2	2	3	4	2	2	4	6	6	5	8	6	10	8	9	6	4	4	0	1	1	0	0	0	2·0	2·1	1·7	1·9	9	11	29	44
Sums ..	68	68	66	32	28	20	37	36	41	57	76	59	46	39	47	70	65	74	20	30	34	34	23	23	2.1	2·2	1·5	1·9				
Means ..	67·3			26·7			38·0			64·0			44·0			69·7			28·0			26·7										

Treasurer in Account with the Royal Cornwall Polytechnic Society.

1858.

Dr.				£	s.	d.
Balance from 1857				11	6	1
Royal Donations:—						
Her Majesty				5	0	0
Prince Consort				5	5	0
Duke of Cornwall..........				5	0	0
Members' Subscriptions, 1858,				135	17	6
Arrears of ditto				4	10	0
Subscriptions and Donations from Mines:—						
Wheal Seton ..	5	5	0			
South Francis ..	5	5	0			
Wheal Buller ..	5	0	0			
Wheal Lovell ..	2	2	0			
United ..	5	0	0			
Wheal Clifford ..	5	0	0			
Wheal Basset ..	2	0	0			
Fowey Consols ..	2	0	0			
Par Consols ..	3	0	0			
Wheal Friendship	2	2	0			
Dolcoath ..	5	0	0			
North Roskear ..	2	2	0			
St. Ives Consols	1	1	0			
West Caradon ..	2	2	0			
				46	19	0
Receipts at Exhibition				97	6	8
Catalogues				7	7	0
Rent of Hall				49	18	0
County Court ..				25	7	9
Rent of Tenements				13	13	0
Received for Competition				1	4	0
Balance of Petty Cash from 1857				3	16	5
				£412	10	5

Cr.	£	s.	d.
Paid in Prizes and Premiums..	92	7	6
Mr. Johns for payments, including Mrs. Hopkin's Annuity, Insurance, Repairs of Hall, &c.	26	19	1
Secretary's Salary	80	0	0
Gas	15	9	2
Advertising, Posting, &c.	10	4	6
Commission, Agent distributing Bills, &c. ..	5	12	9
Carriage of Pictures fm. London & Manchester, cases, packing, &c. ..	17	2	4
Expenses of Exhibition	15	14	0
Elliot, Brothers, for Instruments	1	5	4
Downing	2	10	3
Bullocke	5	10	0
Richards, extra money ..	2	10	0
Dunstan	20	0	0
Strong	1	2	8
Stamped Cheques	0	6	6
Maunder ..	3	0	0
Lancaster	4	14	1
Gill, for Printing	5	7	0
Dixon, Catalogues, Stationery, &c. ..	10	15	10
Richards	6	7	4
Stamps, Postages, &c.	10	14	6
Rates and Taxes	4	3	6
Attendant at Hall when let ..	4	9	9
Wages of ditto	5	0	0
Hall expenses	6	13	5
Carriage of Parcels, Books, Cases, &c.	8	11	1
Travelling expenses ..	3	10	0
Lake	1	12	6
Interest on Loan	12	1	10
	£383	14	7
Balance in Bankers' Hands ..	28	15	10
	£412	10	5

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* Hicks, W. R.	1	0	0
Howell, Francis, *Ethy*, *Vice-President*	1	1	0
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Rogers, Rev. St. Aubyn	0	5	0

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* Bickford, J. S.	0	10	0
Bickford, H.	0	5	0
Lean, T., *Praze*	0	5	0
Newton, L.	0	5	0
Paul, James, *Rosewarne*	0	10	0
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* Rule, John	0	10	0
* St. Aubyn, Rev. H. Molesworth	2	2	0
* Smith, G., L.L.D., F.A.S., &c.	0	10	0
Smith, W. Bickford	0	10	0
Vivian, W., *Tuckingmill*	0	5	0
* Vivian, Capt. N.	0	10	0

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Banks, E.	0	5	0
* Barclay, David, F.G.S.	1	1	0
* Barclay, J.	0	5	0
Barclay, Mrs.	0	5	0
Bastian, H. C.	0	5	0
Batting, Norman	0	5	0
Batting, William	0	10	0
Baynard, James	0	10	0
Baynard, Mrs.	£0	10	0
Beauchant, T. S.	0	5	0
Beauchant, Mrs.	0	5	0
* Bennetts, J.	0	5	0
Blake, Miss	0	5	0
Blight, Samuel	0	5	0
Blight, Mrs.	0	5	0
* Boase, Dr.	0	5	0
Boulderson, Miss	0	5	0
Bottrall, C.	0	5	0
Bottrall, Miss	0	5	0
Bottrall, Miss Emily	0	5	0
* Bradfield, H.	0	5	0
* Broad, R.R., K.N.L., K.S.M.	0	10	0
Broad, Miss	0	5	0
Broad, R. R., jun.	0	5	0
Broad, William	0	5	0
Broad, Mrs. W., jun.	0	5	0
Brougham, Stephen	0	5	0
Bull, Mrs., *Marlborough Cottage*	0	5	0
* Bull, M. V.	0	5	0
Bull, Mrs. M. V.	0	5	0
Bullmore, F. C.	0	5	0
Bullmore, W. K.	0	5	0
Cardew, Mrs.	0	5	0
Cardew, Miss	0	5	0
Carkeet, Miss	0	5	0
* Carne, William	1	1	0
* Carne, E. Clifton	0	10	0
Carne, E. C.	0	10	0
Cobon, E.	0	10	0
* Coope, Rev. W. J.	0	5	0
Copeland, S., *Constantine*	0	5	0
Cornish, Miss	0	5	0
Cuttance, E.	0	5	0

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	£	s.	d.
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Downing, Joseph V.	0	5	0
* Downing, J., jun.	0	5	0
Downing, J. E.	0	5	0
Dunstan, T., *Constantine*	0	5	0
Earle, James	0	5	0
Edmonds, Stephen	0	5	0
Edmonds, Mrs.	0	10	0
Egan, Rev. M.	0	5	0
Fenwick, Col., C.B.	0	10	0
Fenwick, Miss	0	5	0
* Fox, Charles, *Trebah*	1	1	0
* Fox, Mrs. C.	0	10	0
* Fox, R. W., F.R.S.	2	2	0
Fox, Mrs. Charlotte, *Tottenham*	0	10	0
* Fox, Miss Anna Maria	0	10	0
* Fox, Miss Caroline	0	10	0
Fox, Joshua, *Tregedna*	0	5	0
* Fox, Alfred	1	0	0
Fox, Mrs. A.	0	5	0
* Fox, A. Lloyd	0	10	0
* Fox, Samuel T.	0	5	0
Fox, Howard	0	10	0
Fox, Mrs. R. B., *Roscrow*	1	0	0
* Freeman, John	1	1	0
Freeman, J. D.	0	10	0
Freeman, Mrs.	0	10	0
Gait, William	0	5	0
Genn, James D.	0	5	0
* Genn, W. J.	0	5	0
Genn, Mrs. W. J.	0	5	0
Gilbert, Edward	0	5	0
Glasson, Mrs.	0	5	0
Groube, Miss	0	5	0
Hall, R. T., *Deveron*	0	5	0
Hall, Mrs. R. T.	0	5	0
Hart, Thomas	0	5	0
Hawkey & Co.	2	2	0
Hocking, Philip	0	5	0
Hocking, James	0	5	0
Hodges, S., *Secretary*	0	5	0
Hodges, Mrs.	0	5	0
Hooper, J	0	5	0
Hooper, Mrs.	0	5	0
* Horsford, T. M.	1	0	0
Hunt, J. H.	0	5	0
Husband, J.	0	5	0
* Hustler, J.	£0	10	0
Hustler, William	0	10	0
Hustler, Miss	0	5	0
Jacob, M. J.	0	5	0
* Jago, Lieut. R. N., *Hon. Sec.*	0	10	0
Jago, John, jun.	0	5	0
Jago, Thomas	0	5	0
Johns, T.	0	5	0
Kinsman, Rev. R. B., *Tintagel.*	0	5	0
* Kinsman, J. K.	0	5	0
Lake, Mrs.	0	10	0
Lamb, Capt.	0	5	0
Lancaster, J.	0	5	0
Maule, Mrs.	0	5	0
Merifield, William	0	10	0
Miller, Capt.	0	5	0
Miller, H.	0	5	0
Miller, Mrs.	0	5	0
Olver, T. jun.	0	5	0
Olver, W. Slade	0	5	0
Olver, Jacob, jun.	0	5	0
Peters, Rev. M. N., *Penwarne.*	1	0	0
* Pender, W.R.T.	0	5	0
Pender, R. C.	0	5	0
* Phillips, William	0	10	0
Phillips, Mrs.	0	5	0
Phillips, J. H.	0	5	0
Phillips, R. V.	0	5	0
Philp, James G.	0	5	0
Renfrey, F. E.	0	5	0
Richards, R. C.	0	5	0
Richards, Miss R.	0	5	0
Rickard, Rev. R. F. B.	0	5	0
Roberts, John	0	5	0
Rogers, William	1	0	0
* Rogers, Rev. W., *Mawnan*	0	10	0
Rogers, Hender	0	10	0
Rule, J.	1	0	0
Sawlez, Capt., R. N.	0	10	0
Squire, Lovell	0	10	0
Squire, Lovell, jun.	0	5	0
Squire, Anson	0	5	0
Stephens, J., *Ashfield*	0	5	0
Still, John	0	5	0
Symonds, J., *Constantine*	0	5	0
Symonds, Rev. J., *Baldhu*	0	5	0
Thomas, Richard, *Mellingey*	0	10	0
* Tilly, T. H.	0	10	0

Tilly, Mrs. T. H.	£0	10	0
Tilly, H.	0	5	0
Tregellas, Misses	0	10	0
Trethowan, J.	0	5	0
Trethowan, Mrs.	0	5	0
Tweedy, E. B., *Treasurer*	0	10	0
Tweedy, Mrs. E. B.	0	10	0
Ustick, S. Nowell	1	0	0
* Vigurs, R. C., M.B., *Hon. Sec.*	0	10	0
Vigurs, Miss	0	5	0
Webber, T.	0	5	0
White, J.	0	5	0
* Williams, Richard	0	10	0
Williams, Miss	0	5	0
Williams, Miss Emma	0	5	0
Williams, E. W.	0	5	0
Zupelli, M.	0	5	0

FLUSHING.

Peter, Miss	1	1	0
Symonds, T., *Little Falmouth*	1	0	0
Warren, Miss	0	5	0

GWENNAP.

* Bain, Richard, *Burncoose*	0	10	0
* Harvey, Richard	1	0	0
Rogers, Rev. Saltren	0	5	0
Williams, J. M., *Pengreep*	2	2	0
* Williams, William, *Tregullow*	1	0	0

HAYLE.

* Harvey, Nicholas	1	0	0
Husband, W.	0	10	0
Poole, J., jun.	0	5	0
* Punnett, Rev. J., *St. Erth*	0	5	0
Punnett, Macaulay	0	5	0
Richards, Capt. T.	0	5	0
Tresidder, W. T., *St. Ives*	0	5	0

HELSTON.

* Grylls, Glynn	0	10	0
* Moyle, M. P.	0	10	0
* Popham, C. W., *Trevarno*	1	0	0
* Rogers, John J., *Penrose*	1	1	0
* Vyvyan, Sir R. R., Bart., *Trelowarren*	1	0	0

LISKEARD.

* Allen, John	0	10	0
Buller, J. F., *Morval*	2	2	0
* Carew, Wm. H. Pole, *Antony*	£1	1	0
* Couch, J., F.L.S., *Polperro*	0	5	0
* Crouch, E. A.	0	5	0
Elliot, Samuel	0	5	0
Glencross, Rev. J.	0	5	0
* Pedlar, E. H.	0	5	0
Rimell, Rev. E., *Marystowe, Launceston*	0	5	0
* St. Germans, Earl of, *Port Eliot*	1	1	0
* Trelawny, Sir J. Salusbury, Bt., *Vice-Pres.*, *Harewood*	1	0	0

PENRYN.

Carnell, J., *Perran*	0	5	0
Dyke, Miss, *Carclew*	0	10	0
* Enys, J. S., F.G.S., *Enys*	2	0	0
Gill, T.	0	5	0
Hosken, R.	0	10	0
* Lemon, Sir Charles, Bart., F.R.S., *Carclew, President*	2	2	0
Sowell, R.	0	5	0
Mead, J.	0	5	0
Read, J. W., *Trevissome*	0	10	0
Rogers, J., *Hon. Sec.*	0	10	0
Rowe, J. R.	0	10	0
Trenery, George	0	5	0

PENZANCE.

Bevan, C. Dacres, *Boskenna*	1	1	0
* Bolitho, T. S.	1	0	0
Branwell, R.	0	5	0
* Couch, R. Q.	0	5	0
Davy, R. V.	0	5	0
Davy, Humphry	0	5	0
* Flamank, James	0	5	0
Henwood, Wm. Jory, F.R.S., F.G.S.	0	5	0
* Pearce, Richard	0	10	0
Renfree, Thomas	1	0	0
Roscorla, John	0	5	0
* Rodd, E. H.	0	10	0
* Smith, Augustus, M.P., *Scilly*	2	2	0
St. Aubyn, J., M.P.	1	0	0
* Vibert, John Pope	0	10	0

REDRUTH.

Bassett, J. F., *Tehidy, Vice-Pres.*	2	2	0
* Blee, Robert	0	10	0

* Davey, Stephen, *Vice-Pres.* ...	£1	1	0
Davey, Richard, M.P., F.G.S.	1	1	0
Hocking, J., C.E.	0	5	0
* Jenkin, Alfred, *Treworgie* ..	0	10	0
* Magor, J. P.	1	0	0
Reynolds, Charles, *Trevenson* ..	0	10	0
* Richards, Capt. William	1	0	0
Richards, Miss	0	10	0
* Sims, James	0	10	0
Tweedy, Robert ..	0	10	0

ST. AUSTLE.

Drake, Dr.	0	5	0
* Jenkin, Rev. D., *St. Goran* ..	0	5	0
* Rashleigh, Sir J. C., Bart., *Prideaux, Vice-Pres.*	0	10	0
* Tremayne, J., *Heligan*	2	2	0

TRURO.

* Barham, C., M.D.	0	10	0
Barham, Mrs. ..	0	5	0
Baxter, Mrs. Richard	0	5	0
Bond, W. H.	0	10	0
Brittan, C.	0	5	0
Brune, Mrs. Mary Prideaux, *Padstow*	1	0	0
Cotesworth, D.	0	5	0
* Carlyon, C., M.D. ..	1	0	0
Carlyon, Mrs. C.	0	5	0
Carlyon, Miss H.	£0	5	0
Champion, Mr. H. R.	0	10	0
* Falmouth, Rt. Hon. Viscount	2	2	0
Gilbert, Hon. Mrs., *Trelissick* ..	1	0	0
* Gregor, G. W. F.	2	2	0
Gwatkin, Mrs.	1	0	0
* Hawkins, C. H., *Trewithen* ..	1	0	0
Heard, Edward	0	5	0
Jago, James, M.D. ..	0	5	0
Jackson, Mrs. F.	0	5	0
Michell, W.	1	1	0
* Phillpotts, Rev. T., *Feock, Vice-Pres.*	0	10	0
Polwhele, Colonel ..	0	10	0
Remfry, G. F.	0	5	0
Reynolds, Adml. Sir Barrington, K.C.B., *Vice-Pres.*	1	1	0
* Roberts, Joseph	0	10	0
Rodd, Rev. H. T., *Gwinnear* ..	0	5	0
Rogers, Reginald	0	10	0
Smirke, E., *Vice-Warden of the Stannaries*	2	2	0
* Smith, P. P.	0	10	0
Stackhouse, Miss Emily ..	0	10	0
Stokes, H. S.	0	10	0
Tregellas, T. S.	0	5	0
Tweedy, Mrs. W. M.	0	5	0
* Vivian, J. Ennis ..	1	0	0
* Williams, H., *Carnanton*	1	0	0

SUBSCRIBERS RESIDENT OUT OF THE COUNTY.

LONDON.

Baxendale, J. ……	2	2	0
Bevan, C. Dacres ….	1	1	0
Blacket, J. ……	0	10	0
Burnard, N. N., 36, *High-street, Belgrave-road, Pimlico* ..	0	10	0
Bunsen, E. ….	1	0	0
Fox, S. L., *Tottenham* ….	0	10	0
Gurney, S., Esq. W. P. ..	2	0	0
Hunt, Robert, F.R.S. ….	0	5	0
Hunt, Mrs. ……	0	5	0
Scott, Miss ….	0	5	0
Smirke, E., *Vice-Warden of the Stanneries, Cheltenham* ….	2	2	0
Smyth, W.W., M.A., F.R.S. ..	1	0	0
Snell, G. ….	0	10	0
Taylor, John, F.R.S., &c. ….	2	2	0
Taylor, John, jun., *Bayswater* .	1	1	0
* Taylor, Rd., F.G.S., *Hon. Sec.*	2	2	0

PLYMOUTH AND DEVONPORT.

Brewer, J. ….	0	5	0
Bulford, Augustus ……	0	5	0
* Buller, Sir Anthony, *Pound* ..	1	1	0
Balkwill, A. P. ….	0	5	0
Cook, S., jun., *Frankford-st.* ..	0	5	0
Foster, J. B., 5, *Cambridge-st*..	0	5	0
Hearder, J. N. ….	0	5	0
Latimer, I. ……	0	10	0
Marsh, W.W., 10, *Union-terrace*.	0	5	0
* Mount Edgecombe, Earl of ..	2	2	0
Randle, J. ….	0	5	0
Trego, W., *St. Michaels'-terrace* .	0	5	0

Coad, T. P., *Philadelphia* ….	0	5	0
Dymond, W., *Exeter* ……	0	5	0
Gosse, P. H., F.R.S., *Torquay*..	0	5	0
Long, J., *Tiverton* ….	0	5	0
Michell, S., *Mount Radford, Exeter* ….	0	5	0
Palmer & Stone, *Exeter* ..	0	5	0
Pascoe, Rev. R. C., A.M., *Harberton, Devon* ….	0	10	0
Robjohns. W., *Tavistock* ……	0	5	0
Rundle, W. W., *Liverpool* ….	0	5	0
Trevithick, T., *Conway, North Wales* ……	0	10	0
Tucket, Francis Fox, *Frenchay, Bristol* ….	1	0	0
Vivian, Wm., *Conway, North Wales* ……	1	10	0
Williams, W., *Topsham* ….	0	5	0

SUBSCRIPTIONS AND DONATIONS FROM MINES.

Dolcoath, *per Capt. Thomas* ..	5	0	0
Fowey Consols, *per Major Davies*	2	0	0
Par Consols, *ditto* ….	3	0	0
North Roskear, *per W.Darke*..	2	2	0
St. Ives Consols, *ditto* ….	1	0	0
South Francis, *per R. R. Broad*	5	5	0
United Mines, *per H. Sims* ….	5	0	0
West Caradon, *per E. A. Crouch*	2	2	0
Wheal Basset, *Donation per W. Richards* ……	2	0	0
Wheal Buller, *per S. & R. Davey*	5	5	0
Wheal Clifford, *per Williams & Son* ….	5	0	0
Wheal Friendship, *per J. Matthews* ……	2	2	0
Wheal Lovel, *per W. Carne* ..	2	2	0
Wheal Seton, *per T. H. Tilly* .	5	5	0

ROYAL CORNWALL POLYTECHNIC SOCIETY,

FOR THE ENCOURAGEMENT OF

SCIENCE AND THE FINE AND INDUSTRIAL ARTS,

INSTITUTED 1833.

Patroness.

HER MOST GRACIOUS MAJESTY QUEEN VICTORIA.

Vice-Patron.

HIS ROYAL HIGHNESS THE PRINCE CONSORT.

Vice-Patroness.

HER ROYAL HIGHNESS THE DUCHESS OF KENT.

President.

SIR CHARLES LEMON, BART., F.R.S., &c.

Vice-Presidents.

SIR JOHN S. TRELAWNY, BART.
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R. R. BROAD, ESQ., K.N.L., K.S.M.
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Treasurer.

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R. C. VIGURS, ESQ., M.B.
THOMAS ROGERS, ESQ.

Secretary.

MR. SYDNEY HODGES, FALMOUTH.

LIST OF PREMIUMS AND PRIZES

FOR 1859.

PREMIUMS.

NOTICE.—The Society, in all cases, reserves the power of rewarding each communication in proportion to its merit, or even of withholding the Premium altogether.

Competition not confined to members, or residents in Cornwall.

1. MINE VENTILATION.—The following sums have been subscribed for promoting Improved Ventilation in the Cornish Mines:—

Royal Cornwall Polytechnic Society..	£50
Hon. Mrs. Agar	10
John J. Rogers, Esq.	10
United Mines Adventurers	10
T. J. A. Robartes, Esq., M.P.	5
Rev. H. Molesworth St. Aubyn	5
Augustus Smith, Esq., M.P.	5
C. F. Giesler, Esq.	5

It has been determined that the amount shall be divided into four premiums as specified below:—

Two premiums, one of £50 and another of £25 (to be further augmented in the same ratio as donations to the funds shall allow), to be given to the agents of the first and second best of the two mines in which, under the circumstances of the case, the ventilation shall be most complete; regard being particularly had to "close ends," and the extent to which effective ventilation is carried from the main natural draughts. The effectiveness of the ventilation, both with respect to the quantity and quality of the air supplied, to be tested in such manner as the adjudicators of the premiums may deem satisfactory. The premiums must be applied for, at least two months before the annual exhibition of the society, and if awarded are to be paid to the adventurers of the mines for distribution by them amongst their agents.

A premium of £10 for the best model, and a premium of £5 for the best plan, for increasing the ventilation of mines, especially in those parts which are difficult to reach by natural ventilation.

The Polytechnic Society offers the above premiums for competition, in the hope of directing attention to the importance of improving the ventilation of the Cornish mines. Tables exhibiting the comparative early decease of Cornish miners, and Papers connected with this subject, have been printed in several of the society's annual Reports, and they shew that working in deep mines is frequently attended with the sacrifice of health and the abridgement of life. The evil appears to arise from the miners often working in a stagnant atmosphere, impregnated with deleterious gases and deficient in oxygen, which is so essential to the preservation of life. Attention should be drawn to the subject, whether the draughts obtained in mines by winzes at a distance from the shaft are in many cases local only, and consisting of circuits of vitiated air.

The larger portion of this fund will be distributed with the view to encourage practical ventilation rather than the discovery of new methods of effecting it, as it is believed that the latter are not so much required as the judicious direction and use of the natural draughts; and, where these are insufficient, the introduction of such mechanical aids as have been already found effective. The machines at present employed are—first, the reciprocating pump, in various forms, for forcing or extracting air; second, fans, rotating at high velocities; third, rotatory air pumps, constructed somewhat on the principal of the rotatory steam engines. The last have been successfully applied in France and Belgium, although they appear to be little known in Cornwall. As these machines require only a slow motion, and give a continuous current of air without changing its direction, they seem well adapted for the ventilation of our mines in those cases where machinery is requisite.

2. DRESSING ORES.—A premium of Twenty Pounds, by the Editor of the *Mining Journal*, and by the society (or such portion thereof as the judges shall consider suitable), to the originator of improvements in the dressing of ore; such improvements to have been in successful operation for a period of not less than six months.

3. IMPROVEMENT IN MINING.—A premium of Five Pounds, by the late Editor of the *Mining Journal*, for the best Paper containing an account of any methods, or plans, practised in any other mining districts, advantageously applicable to the Cornish mines. To be accompanied by the necessary drawings.

Note.—The introduction of improved methods of drawing the ores and rubbish from the Cornish mines appears to the committee to be worthy of attention with reference to this premium.

4. DRIVING LEVELS.—Premiums of Seven Guineas, Five Guineas, and Two Guineas, by Charles Fox, Esq., for the best Reports of comparative experiments or trials, made under the eyes of the competitors since Sept. 1855, of the relative expense of driving levels in granite or killas, "working big," and of ordinary height; and of driving others of not less than 6 feet in width, and of proportionate height. The ground should not be of less hardness than £6 per fathom. The tramming may be reduced to 20 fathoms and the hauling to surface at 80 fathoms, as a standard, the landing to be included in the cost. Experiments in carrying an end 8 feet wide would be more satisfactory than driving one only 6 feet wide, as the advantages or disadvantages of an end 8 feet wide would be more manifest than when it was only 6 feet. Time being as important an element as money in the cost of mining operations, it is desirable that the time spent in driving "wide" and "narrow" levels in rocks of nearly equal hardness should also be stated.

Note.—An end which has a "hulk" or "let go" in some part of it, does not admit of a fair comparison.

5. MINERAL VEINS.—A premium of Five Pounds, by the society, for the most exact account of the phenomena of mineral veins in any mine or district, their dip, direction, variations in productiveness, slides, heaves, &c. The Society being especially desirous of cultivating close habits of observation in our miners, will give prizes for accurately drawn cross sections; for collections of *ores* and *country* in which the relations of one to the other are carefully marked; for drawings and descriptions of any remarkable phenomena observed in lodes, &c.

6. EDUCATION OF MINERS.—A premium of Eight Guineas (three guineas by Sir Charles Lemon, Bart., and five guineas by the society), for the best Essay on Mining Education as applicable to Cornwall.

7. CONSUMPTION OF COAL, &c.—A premium of Five Guineas, by John Taylor, Esq., F.R.S., for the most complete and accurate accounts of the quantity of water supplied to the boilers, the number of bushels of coals consumed, and the duty performed by an engine, for a period of not less than six months.

8. WORKING PLAN OF A MINE.—A premium of three Guineas by the society, for the best working plan of a mine in full work (sections of the lodes not required). The plan to be corrected to some time within three months previous to its exhibition. To be drawn by the person who dialled the mine-workings, not being a professional dialler, of which satisfactory evidence must be adduced.

9. CURING PILCHARDS.—A premium of Five Pounds, by the society, for the successful curing of not less than 1,000 pilchards, by some method not generally adopted in this county.

Note.—The Yarmouth method of curing herrings appears to the committee to be worthy of attention in reference to this premium.

10. COTTON NETS.—A premium of Five Pounds, by the society, for the best Report of the use of cotton for the manufacture of pilchard drift nets, seines, &c., especially with reference to durability, economy, and lightness.

PRIZES.

AT THE NEXT ANNUAL EXHIBITION, PRIZES WILL BE AWARDED TO MERITORIOUS PRODUCTIONS IN ANY OF THE FOLLOWING DEPARTMENTS:—

MECHANICAL DEPARTMENT.

NATURAL PHILOSOPHY.—CHEMICAL ANALYSIS.—
MECHANICAL AND OTHER SCIENTIFIC INVENTIONS AND IMPROVEMENTS.—
MODELS OF MACHINERY, NOT DISPLAYING INVENTION.—
NAVAL ARCHITECTURE.

Inventions and improvements should be accompanied by accurate models or drawings, and explicit descriptions. The drawings should be on a scale large enough to admit of their being seen when hung against the walls of the room; and all descriptions or communications should be written on foolscap paper, on one side only, leaving 1½ inch margin.

The Society being wishful to encourage excellence of workmanship in the handicraft trades and tools, will place at the disposal of the judges a certain number of prizes to be awarded to apprentices and artizans.

Note.—The society will empower the judges to award a reasonable remuneration for the time and labour devoted by *working men* to the production of any deserving models or machines which may be exhibited by them.

FINE ARTS.

SCULPTURE AND MODELLING.—OIL PAINTING.—WATER COLOURS.—PENCIL, CRAYONS, ETC.—ENGRAVING AND ETCHING.—LITHOGRAPHY.—ARCHITECTURE.—ORIGINAL DESIGNS ADAPTED FOR MANUFACTURES IN SERPENTINE, GRANITE, PORPHYRY, ETC.

Competition in this department is restricted to Amateurs.—For regulations respecting the productions of Professional Artists, see page 8.

Premiums of One Pound each are offered for the following subjects:—

1. For the best filled sketch-book from Nature.
2. For the best series of six flowers from Nature, in chalk or pencil.
3. For the best series of six sketches, in water colours, of different rocks, shewing their jointed structure and characteristics.
4. For the best water-colour drawing of the common Bramble or Blackberry, the Red Poppy, Burdock, Mallow, Foxglove, or Hemlock, strictly from Nature, to be made, separately, the natural size.

Note.—The judges recommend attention to the foreshortening of the stems and leaves, and to the shadows cast by one leaf on another.

5. For the above subjects in simple outline.
6. For six outlines of stems and branches of British Trees, on imperial-size paper, giving carefully the forms of leaves and anatomical characteristics of stems.
7. For the best series of original sketches of our Cornish Antiquities,—Celtic, Roman, or Saxon.
8. For the best series of six outlines of the human hand or foot, life size, from the cast, or from life; indicating light and shade by the lightness or strength of the outline.
9. For the best shaded crayon drawing of one of the busts in the Polytechnic Hall, full size, or the bust of any well known character.
10. For the best isometrical drawing of a building in the county.
11. For the best engraving on wood, or lithograph.

The following objects may also be selected by successful competitors in lieu of money; *and may also be competed for by previous prize-holders*:—

Statuettes in Parian; Engravings from the Old Masters; from Scheffer's Pictures,—"Dante and Beatrice,"—"St. Agustine and his Mother,"—"Christ blessing the little Child;" Prints in colour, from Turner, Landseer, Hunt, &c.; Photographs and Stereoscopic Views; Ruskin's Lectures on the Elements of Drawing; Harding's Studies of trees: Burnett on Composition; Barnard on Water-colour Painting; Kugler's Hand-book of Painting, *Illustrated;* Rogers' Poems,—*Turner's Illustrations;* Tennyson, *Illustrated;* Longfellow, *Illustrated;* Evangeline, *Illustrated;* Wordsworth's Greece, *Illustrated;* Flaxman's Works; Cunningham's Lives of British Painters; Raffael's Bible, from Frescoes in the Loggie at the Vatican; Childe Harold, *Illustrated;* Stereoscope; Microscope; Portable Sketching-stool; Oil or Water Colour Box, fitted.

SCHOOL PRODUCTIONS.

PRIZES FOR SCHOOLS, OR YOUTHS UNDER 16 YEARS.

A prize of £1, for the best series of six perspective outlines, with original illustrations.

Prizes of £1, 10*s*., and 7*s*. 6*d*., for the best mechanical drawings.

Prizes of £1, 10*s*., and 7*s*. 6*d*., for the best series of drawings from objects or models.

Prizes of 10*s*., 7*s*. 6*d*., and 5*s*., for the best water-colour drawings.

Prizes of 10*s*., 7*s*. 6*d*., and 5*s*., for the best pencil or crayon drawings.

Prizes of 10*s*., 7*s*. 6*d*., and 5*s*., for the best maps.

Prizes of 10*s*., 7*s*. 6*d*., and 5*s*., for the best specimen of penmanship.

Note.—Plain writing and printing on a sheet of foolscap, will better meet the views of the committee, than the more decorative styles which have been hitherto sent for exhibition.

Prizes of 10*s*., 7*s*. 6*d*., and 5*s*., for the best series of drawings from objects or models, by boys belonging to National and British Schools.

The conductors of schools in this County are invited to encourage their pupils to compete for the foregoing prizes (also for the premiums for persons under 18 years), and to prepare other productions for the exhibition, as suitable prizes will be awarded to the most deserving.

Note.—It is required that with respect to the productions of persons under 18 years it may be stated that each drawing or map is the unassisted work of the exhibitor.

NATURAL HISTORY.

ESSAYS.—LOCAL OBSERVATIONS.—COLLECTIONS OF SPECIMENS, PARTICULARLY SUCH AS ILLUSTRATE THE NATURAL HISTORY OF THE COUNTY.

Specimens sent for competition should be properly arranged and accurately named.

Prizes will be especially given for Monographs of any particular family or large genus indigenous to the county, either in Botany or Zoology, such as the *Gramineæ* or the *Hieraceæ*; the *Holothuriadæ* or the *Medusæ*; the *Palmipedes*; the *Rodentia*; &c., &c.

A premium of Two Guineas for the best Illustrated Journal of Natural History, by persons under 20, on the plan of Mr. Cocks' Medley.

A premium of £3, by Mrs. Barclay Fox, for the best Calendar of Nature, presenting in a tabular form the comparative view of the dryness or moisture of different years; exhibiting also the advance of the seasons by the time at which various trees, plants, &c., burst into leaf or flower, taking, of course, the same tree each year. The candidates to be under 18 years of age .

A premium of £1, by Miss Bell, for the best specimen of cultivated Blackberries.

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SYDNEY HODGES,

Falmouth.

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POLYTECHNIC SOCIETY.

ESTABLISHED A.D. 1833.

THE TWENTY-SEVENTH

ANNUAL REPORT.

1859.

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SOLD BY Mrs. LAKE & R. C. RICHARDS.
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"It is refreshing to read of endeavours after self-improvement by working men in a remote part of the realm, while hundreds in London, which claims to be the most enlightened of cities, enact laws to forbid self-improvement, and actually throw themselves into idleness and penury, at word of command."

A short extract also from the *Plymouth Mail*, written by a gentleman who visited Falmouth and the Polytechnic for the first time, cannot fail to be gratifying to the members of the Society. It is as follows:—

"The Polytechnic Society is certainly a great credit to Falmouth and to Cornwall. We do not think this product of the far west can be paralleled elsewhere in England. Even London's Polytechnic Society was an imitation of it. It is difficult to estimate the enormous value of such a Society to a district. The intellect and imagination are kept alive by it; invention is stimulated; the most recent scientific discoveries become generally known; and the performances of the higher minds permeate the lower intellectual strata. We wish there were a Polytechnic Society in every county of England."

It is gratifying also to record that there has been an increase in the number of subscribers this year more than sufficient to counterbalance the losses by deaths and withdrawals, although among the latter must be enumerated the withdrawal of a subscription of five guineas from the Wheal Buller mine, and two guineas from North Roskear.

The new regulation which was introduced last year, enabling the judges to award medals to patented and registered articles, appears to work very satisfactorily, as applications to inventors at a distance to forward their models for exhibition, have been in nearly all cases responded to, in some instances at a very considerable expense to the owner. In connection with this regulation, your committee have great pleasure in referring to a letter received by your secretary from Mr. C. Clifford, the inventor of the celebrated boat-lowering apparatus exhibited here the year before last, and who was one of the first who benefited by the altered rule with regard to patents. Mr. Clifford writes—"You will have seen the progress my system (to which your institution awarded the first public prize it ever obtained,) has made, and the practical results it has achieved in saving life, and I am sure such cannot fail to be gratifying to the members of your institution and to yourself. I assure you such amply repays me for all my past labour. With a lively sense of all your past kindness in my behalf, believe me, very truly yours, Charles Clifford."

The important subject of the education of miners, which has occupied the thoughts of many of your members for some years past, has this year been brought more directly before the county, chiefly through the instrumentality of Professor Hunt, who has organized a scheme for a Miners' Institution, which, if supported, would be of great practical benefit both to the working miner and the man of science. Your committee have continued their connection with this movement by authorizing your secretary to attend as a deputation at the late meeting at Camborne, and as he is appointed one of the working committee, the Polytechnic will continue to aid the movement in any way it is able.

Your committee record with gratification the valuable assistance received by several gentlemen during the Annual Exhibition, who kindly favoured the Society with lectures and papers. Your thanks are especially due to Professor Hunt for his excellent lecture on "Some recent Discoveries in Light and Colour," for his valuable report of the Mechanical department, and for his general kindness and assistance during the exhibition; to Mr. J. A. Phillips for his able and instructive lecture on "Waste Minerals;" to Mr. G. Fox for his interesting address on "Bees;" to Mr. J. N. Hearder for his two admirable lectures on "Submarine Telegraphs," and on "The Induction Coil," and to Mr. Osler for his most interesting observations on the History of Falmouth Harbour.

You are again indebted to Messrs. W. and J. Freeman for the magnificent specimens of polished granite which ornamented the Hall, portions of a monument erected to Lord Clive at Shrewsbury. Also to Messrs. Harrison, of Newcastle, for their very elaborate models of jetties; to the agents and captains of mines, and to the working miners themselves, as well as to various gentlemen, tradesmen, and mechanics in the neighbourhood you are indebted for many interesting plans and inventions, a detailed account of which will appear in the report of the Exhibition itself. In the Fine Arts Department you are again indebted to Mr. S. Gurney for the loan of several valuable pictures; also to Sir Samuel Spry, Captain Wodehouse, R.N., Mr. David Barclay, Mr. C. Rule, Mr. Pryor, of Redruth, Mr. E. W. Williams, Mr. J. Dennis, and Mr. Schwerer, Mr. W. Batting, and Mr. Hancock, for interesting contributions to this department.

In the Naval Architecture department there was nothing of sufficient promise to merit a special notice out of the usual place; but in that of Natural History your committee are pleased to record an increasing and praiseworthy industry among both old and young contributors, which continues to maintain the interest always attaching to this delightful study. In the Amateur department of the Fine Arts also they have to record the contribution of one of the best oil paintings from nature, and two of the finest water colour drawings perhaps ever exhibited, to which silver medals were awarded, the former by Mr. Lenderyou, the latter by Mr. Squire, of Truro.

Your thanks are also due to Mr. A. Chimmo, of H.M.S. Russell for an interesting collection of Chinese curiosities taken at the bombardment of Canton; to Capt. Valler for several beautiful cases of stuffed birds and other interesting curiosities; also to the Rev. G. Bull and Mr. J. J. Rogers, M.P., for contributions in the same department. Your thanks are also due to those gentlemen who have contributed papers to the Society during the past year, among which may be enumerated Mr. J. Couch's interesting paper on the Salmonidæ, Mr. R. Q. Couch's concluding paper on "The Mortality of Miners," and Mr. Cocks' further contributions to the Falmouth Fauna.

The year has not passed without bringing in its train those losses of old friends and supporters which you have almost every year to deplore. The hand of death has removed more than one of those who have always been foremost in supporting the interests of the Polytechnic. Mr. J. Allen, of Liskeard, Capt. Caddy, and Mr. Merefield, are no longer here to assist us with their counsels and advice, and your committee would pay an especial tribute of respect to the memory of Mrs. G. C. Fox, the relict of one who was ever foremost with heart and hand to assist the early as well as the maturer efforts of the Society, and who herself up to the last moment, evinced the warmest interest in everything connected with the Polytechnic; and also to Mr. W. M. Tweedy, whose name will be associated not only with the Polytechnic, but with almost every other institution in the county, as long as they continue to exist.

In referring you to the financial condition of the Society it is gratifying to find that the yearly income is in no way on the decline, but in these efforts to do justice to all the meritorious objects exhibited, the Judges have in the last two years exceeded by some thirty per cent. each year the average amount expended in prizes, and there are also certain assets due to the Society, which from unforeseen causes have not yet been received. Under these circumstances your committee have thought it expedient to draw on the reserve fund to a sufficient extent to meet the current expenses until payments now due are received, and they have every reason to hope that the income for the coming year will be still greater than that of the last, while the expenses will probably be reduced.

THE ANNUAL EXHIBITION.

The Twenty-seventh Annual Exhibition was opened on Wednesday September the 28th. The interest heretofore felt in the Society was again most pleasingly manifested, by the contribution of a collection of art productions, mechanical inventions, and objects of curiosity, which in variety and importance bore comparison with most of the exhibitions of previous years. The Hall presented a very fine and striking appearance. The walls above the gallery were covered with paintings and drawings embracing numerous specimens in every branch of the art, many of the specimens exhibited being gems. Beneath these on tables extending entirely round the hall, were arranged the mechanical and scientific apparatus, objects of natural history, curiosity, and manufacture; and standing prominently forward in the centre of this display, was a magnificent granite pedestal, sent by Messrs. Freeman, and a large and very fine fountain which played during the day, contributed by Mr. J. H. Bullocke. The high polish of the granite pedestal afforded a fine illustration of the perfection to which Cornish granite can be brought, and was an object of admiration to all who visited the hall. It is the pedestal of the statue now erected to Lord Clive, at Shrewsbury.

THE MECHANICAL DEPARTMENT.

The display of models of mechanical inventions, exhibited on the whole an improvement in the general character of the designs. Amongst the inventions, those intended to facilitate the operations in the branch of enterprise with which the county has so long been identified, viz., mining, greatly preponderated. Messrs. A. and E. Paull, of Chacewater, exhibited the model of an invention by them for feeding the fire of engines without opening the furnace doors, and thus to obviate the necessity of allowing the admission of cold air. Another portion of their invention consisted in providing for the passage of the air through inclined bars, by which they hope to effect a more perfect combustion in the method of superheating steam than at present adopted. In the same department were two models by Mr. W. J. Maynard, of Illogan Highway, Redruth, of an apparatus for the prevention of explosions in steam boilers, which was accomplished by an ingenious arrangement of the float in connexion with the safety valve, and for economising the consumption of coal, and providing for the burning of smoke by engines. Captain Goyen exhibited a model of a method of raising ores, adopted in the Morro Velho mine in South America: the object of this invention is to bring the kibble from any spot on which the workings are being carried on, and thereby to save the manual labour of transporting the ore from one part of the level to another. It possessed this advantage, that in case of the breaking of the chain which draws the kibble up, it was instantly stopped from falling by an arrangement of catches. Mr. W. Bennetts, of Tuckingmill, sent a model of his patent skip for preventing accidents by the breaking of the rope, which has been adopted at South Wheal Frances Mine. Mr. J. B. Jordan, of London, exhibited a very ingenious model of a horizontal high pressure steam engine, applicable for mines. The inventor has reduced the steam engine to the most simple form with the view of saving expense, and it was stated that an engine upon this principle of four or five horse power might be purchased for £150. Mr. W. Stevens, of Hayle, sent exceedingly ingenious small models of a double action beam, and ditto rotary engine.

The following models were also exhibited:—

Messrs. Taylor and Company's patent steam winch. A patent adjustable vice, by Messrs. J. Walters and Co., Sheffield, the object of which is to render the vice much stronger than those previously in use, by means of an adjustable leg which passes down to the floor; and as one leg is made to move, the vice is enabled to grasp any tapering or wedge-shaped object as firmly as if it was square or flat. A model of a parallel printing press, invented by Mr. J. Tregaskis, printer, Falmouth, improved and made by Mr. T. Coad. This was a truly ingenious invention. The object is to print by a direct vertical motion instead of by the usual mode of sliding the table or bed plate of the press under the platten. It appears that a press on this principle had been made, and was found to work very well, and so far as could be judged from a model of small dimensions, it appeared well calculated to do this. Mr. Gray, of Liverpool, exhibited a patent floating compass, similar to those adopted on board the "Great Eastern" steam ship. By this plan the compass floats in water, which is suspended at its proper elevation by means of India rubber bands, and the level of the surface of the water being unaffected by the pitching motion of the ship, a remarkable degree of steadiness is preserved. Mr. Pinkey, of Southampton, exhibited a compass with patent corrector for iron ships; and Mr. G. Brown, Deptford, another compass, with patent gravity binnacle. The adjustment of the latter, together with the arrangement for lighting it at night, were exceedingly good. What may perhaps prove to be one of the most important inventions of the present day as likely to solve the difficulty now experienced in the successful working of the telegraph when the wire is submerged for great distances in the sea, presented at first sight a very simple and unattractive appearance, being nothing more than about a foot of what appeared to be dark coloured rope. This, however, was a portion of the telegraphic cable invented by Mr. J. N. Hearder, of which a particular description will be found in another portion of the report. Mr. T. Coad exhibited a very ingenious plasterer's mitreing machine, which appears to facilitate greatly the process of moulding upon walls. Among other objects may be noticed a cowl head by Mr. Bullocke, of Falmouth; an ingenious hydraulic pen, by Captain Ross, of the same place; an improved fastener for cupboard doors, and spindled rim locks, by Mr. W. Bond, Tehidy-park; a safety tube for steam engines by Mr. Samuel Terrill, of Redruth; a cheap and simple surveyor's level for ordinary purposes, by Mr. W. Bond; an exceedingly ingenious electric clock, which not only gives the time of day, but high and low water at a number of different places, and also an electric machine by Mr. J. Bickle, Hayle; an improved pump valve by Mr. W. Bone, Budock; and a model of Taylor's steam hammer. Mr. Harrison, the chief engineer of the Tyne Docks, at Newcastle, sent a most elaborate set of models of the jetties erected at those works, with railways at different levels, so as to suit any state of the tide. A line of rails runs the whole length in front of the jetties, upon which there are self-acting points and switches on a new and very ingenious plan. Mr. J. N. Hearder exhibited an extensive collection of galvanic apparatus, intended to illustrate his lectures on submarine telegraphs and the induction coil.

MANUFACTURES.

In this department there were a number of productions of great interest. Amongst them were many specimens of purified salt-petre from the works of Messrs. Lanyon and Co., of Ponsanooth. which deserve to be noticed as exhibiting the introduction of a manufacture new to the county. Mr. T. Davey, of Tuckingmill, sent a specimen of his blasting powder; and Messrs. J. Williams and Son, hairdressers, Plymouth, sent three wigs, the foundation of one of which being of fine gauze, and most of the hairs put in the gauze singly, it is next to impossible to detect that it is a wig when on the head.

FINE ARTS.

The display in this department was more extensive than has perhaps ever been seen before at any previous exhibition of this society, and though it did not contain any such rare productions as those of Rosa Bonheur and Ary Scheffer, whose pictures decorated the Hall last year, yet the display generally was of higher excellence. At the end of the Hall, which is the first place of honour, owing to the light being the most favourable, was suspended Hayes' portrait of the Queen, after Winterhalter. This occupied the centre of the wall, and was supported by Mr. Hodges' portraits of Col. Fenwick and the late Mr. W. M.

Tweedy. Between the two last was the medallion of Sir Charles Lemon, Bart., and adjoining them were two very fine specimens of S. R. Percy and H. Boddington. Underneath the medallion was a very beautifully painted copy of Raphael's picture, "The Madonna di San Sisto," in the Dresden gallery, by Battoni, the property of Mr. D. Barclay, of Falmouth. Amongst the pictures at this end of the room were specimens by J. Linnell, F. W. Gooderson, and S. Hodges. One by the last named gentleman was entitled "An Eye to Windward," and represented an old fisherman grasping the helm of his vessel, and casting an anxious eye to the storm that appears to be brewing. The painting of the face and figure of the old tar was bold and forcible. At the right hand side of the room was another of Mr. Hodges' productions, entitled "Luna," and has been suggested by the lines of Shelley :—

"That orbed maiden, with white fire laden,
Whom mortals call the moon,
Glides glimmering o'er my fleece-like floor,
By the midnight breezes strewn."

The figure by which the Queen of Night has been symbolized, was painted with great softness and etheriality. Immediately beneath this was a fine "study" of a young peasant girl, painted in water colour by Mr. H. Tidey, M.W.C.S. It was suggested by the lines of the old Scottish ballad,

"But, oh, she's but a young thing,
Just come frae her mammy."

and any one who had the gratification of inspecting the picture and of seeing the beautiful manner in which Mr. Tidey illustrated these words, will not be surprised that her Majesty should have recently added one of this gentleman's pictures to the Royal collection—namely, "The Feast of Roses," which was exhibited at the Water Colour Society this year. Not far from this, No. 141, was a sweet picture,—"Venice—Sunset," by E. W. Cook, A.R.A.; and a very pretty early sketch by R. Buckner, the property of Captain Wodehouse, R.N. Mr. Philp maintained his deservedly high reputation by the contribution of six very fine views of Cornish and Devon scenery, which he knows so well how to depict; and Mr. Williams, of Topsham, had a sweetly painted picture—No. 3, "Evening on the Teign," and three smaller landscapes of equal merit. In addition to these, were a view of that spot dear to artists—"Shaugh Bridge, Devon," contributed by Mr. Hart, and a fine twilight view at Swanpool, both of which were suspended on the opposite side of the hall. Several of the resident gentry in the county contributed pictures, some of them of great value. Sir Samuel Spry sent a portrait of a girl, by Sir Joshua Reynolds, and six other pictures. Mr. F. Pryor, Redruth, a valuable landscape by Berghem, two landscapes by Harding, two poultry pieces by Herring, and one or two other pictures. Mr. W. Batting contributed a fine old painting of St. Francis; and Mr. S. Gurney, one of the members for Falmouth, an admirable portrait of his father. Mr. Rule contributed three pictures—an "Ascension" and two views in Mexico.

The collection contributed by amateurs was very extensive, and it was remarkable chiefly for containing two original paintings, and one copy which far surpassed in point of merit any similar productions by this class for many years. The former consisted of two water-colour landscapes by Mr. Squire, of Truro. This was understood to be the first time that Mr. Squire has exhibited in public. The third picture was a copy of Guido's "Ecce Homo," by Miss Dunn, of Truro; very beautifully painted. Thus it will be seen that to Truro belonged the honour of furnishing the three best amateur pictures in the exhibition. The Penzance School of Art sent a number of very superior contributions, and we must here mention, that in the exhibition at Marlborough House, no less than at those in the county, the pupils in this school appear to surpass those of any other similar institution. In the productions sent by the pupils attending various schools in the county, a marked advance was perceptible, nearly all of them affording evidence of a closer observation of nature, and more careful and finished execution. The lady amateurs fully kept pace with their rivals of the opposite sex. Miss J. Gatley, of

Truro, exhibited a crayon drawing of "Pharaoh's Horses," a group of three heads, which was a spirited and truly admirable performance. Miss Gregor, of Trewarthenick, contributed a portfolio of drawings of flowers, which manifested a careful study of nature. Miss B. Squire, of Falmouth, sent some outline drawings of flowers, deserving of warm commendation. The Rev. F. E. Gutteres, contributed a book of very good photographs.

NATURAL HISTORY.

This department comprised several cases of birds, and moth and butterflies, and a number of animals; but the greatest curiosity was a specimen of the Apteryx, a New Zealand bird, apparently without wings and tail. It is stated, that there is only one other specimen in England, which is a live one, at the Zoological Gardens, in London. It was contributed by Mr. S. Gurney, M.P.

NAVAL ARCHITECTURE.

This department included models of the "Great Eastern" steam-ship, Wood's boat-lowering apparatus, and of a number of vessels. There was nothing, however, of very great novelty.

The display of curiosities was considerable; among them a very interesting collection of Chinese curiosities, contributed by Mr. Chimmo, of H.M.S. "Russell," and a very pretty Chinese cabinet, by Mr. S. Hodges. The original service messages sent by the Queen to the President of the United States and the reply of the latter, in August, 1858, the first messages transmitted by the Atlantic Telegraph, as printed by the electric telegraph upon the tape. A beautiful model of the temple and pagoda of Trichinopoly, India. This was cut in India out of the pith of wood, and was brought to this country by the Rev. James Bull, by whom it was exhibited. The material of which it is composed is so light that, although of considerable size, it weighs only a few ounces. Mr. John Roberts, of Falmouth, had a very choice collection of cabinet furniture; and Mr. W. Slade Olver, of the same place, a case of very handsome manufactured silver-plated goods. The latter also exhibited in the mechanical department, an atmospheric bell, by which the use of cranks is superseded. Within the entrance to the Hall was a most extensive display of ladies' needlework, comprising a great variety of articles both ornamental and useful.

The weather, which on the previous day was very fine, proved most unfavourable during Wednesday morning, the rain pouring down frequently in torrents; and the apprehensions for the success of the exhibition naturally became great. Towards noon, however, a change for the better took place; and soon after the sky thoroughly cleared, and the weather throughout the remainder of the day proved as favourable as could have been desired. At eleven o'clock members were admitted, and an hour later, the public; but although the Hall was thronged with a large and fashionable company, it was evident that the wet morning had prevented many persons from attending. Amongst those present were Lord Vivian, the Lord-Lieutenant of the county; the president of the Society, Sir C. Lemon, bart.; Sir John and Lady Duckworth; Rev. Sir Hugh and Lady Molesworth; Mr. Tremayne, the High Sheriff; Mr. R. Davey, M.P.; Mr. J. J. Rogers, M.P.; Mr. M. Smith, M.P.; Mr. Bovill, M.P., and Mrs. Bovill; the Rev. T. Phillpotts and party, &c.

THE ANNUAL MEETING

was held at one o'clock in the large hall, when Sir Charles Lemon, the President of the Society, took the chair. Prior to the commencement of the proceedings, a photographic artist introduced the apparatus of his art, and the company were requested to remain still for a few minutes, until he took a view of the hall and its occupants.

Mr. J. J. Rogers said he had been requested by their esteemed president to open the proceedings by a few general remarks on the exhibition; and in doing so, he must in the first place apologize to the company for appearing before them, and he felt himself incompetent to discharge the duty which their president had performed on former occasions much better than he could hope to do. He should in the first place congratulate the society on the very respectable attendance of visitors, and which, owing to the state of the weather in the morning, far exceeded what they could have anticipated. It was especially gratifying to find such a large number of ladies present; because, had they not been there, their garden would have been without flowers. (Applause.) He thought that it was due to the society to state, in the first place, that it referred with deep regret to the loss of one of its most able and efficient supporters, who, by his knowledge of science and art, and all the other branches in the promotion of which the society had interested itself, had done more than any other member to promote its success. He need hardly mention the name of their respected friend, the late Mr. W. M. Tweedy, as that of the person to whom he alluded. He felt that the society had sustained a great and serious loss in the death of that gentleman. It would doubtless be gratifying to all acquainted with their late friend, to see his portrait hung up in the hall, and to know that an engraving of it was about to be published. With regard to the exhibition, he was happy to state that, upon comparing it with exhibitions of previous years, there was scarcely a department that was not highly creditable. In the mechanical and scientific department, there was an excellent display of inventions, and they would doubtless hear in a few minutes from Mr. Hunt, who was acting as the chairman of the committee of that department, a full description of all the objects that more particularly interested them. That being so, he would merely remark generally, that it was highly creditable to the county to be able to place upon the table of the hall so creditable an exhibition of mechanical inventions. He then referred briefly to the models of the jetties about to be erected at Newcastle, sent by Mr. Harrison; Messrs. Taylor and Co's. steam winch, and some other models; after which he proceeded to notice the fine arts department; but as these have been already described and are referred to in detail in the reports which were presented, it is unnecessary to report his remarks further than to state that he was of opinion a decided improvement had taken place in the quality of the pictures exhibited by artists generally, and now that the railway was opened, they might hope to receive larger contributions from those gentlemen to the future exhibitions of the society. In conclusion, he said that he could not forbear referring to a subject which did not belong to either of the departments to which he had alluded, and which had always received a great deal of attention from the society, particularly as it bore upon a valuable paper which had been contributed by Mr. Couch, of Penzance; he referred to the diseases of miners. It would be recollected that a most important paper was read on this subject at one of their annual meetings, and so valuable did the Society consider it, that they published it in their annual report; and he was sure that every one who had the welfare of miners at heart would receive with gratitude this contribution on the same subject from Mr. Couch. That gentleman, in this document, had divided the county into districts, and he had furnished most valuable statistics as to the nature of the diseases from which miners suffer, extending over a great number of years. He had also intimated that the great point to which attention should be directed with the view of improving the health of miners, was that of the ventilation of mines. He (Mr. Rogers) need not remind the company that that was one of the subjects to which the society had for years directed attention; that it had offered such premiums as it thought would be sufficient to induce those who were engaged in the management of mines to introduce a system of ventilation which would remedy the evils at present existing. He considered that too much attention could not be drawn to the subject, because those engaged in mining formed a large proportion of the population of the county; and, therefore, every effort ought to be made for the preservation of their health. There were doubtless mining agents in the room, and if so, he would remind them that it was extremely important, looking at their own interest, and the interest of a large class of the population, that they should make an effort to introduce an improved and satisfactory system of ventilation into their mines.

The diseases to which miners were subject appeared to be traceable in a great measure to bad ventilation, owing to which they were rendered unfit for work, their lives shortened, and thus the extent of their services and usefulness was greatly curtailed. (Hear.) Those who took an interest in the prosperity of the society would be glad to learn that a number of additions had been made to the subscription list, and that the funds were in a prosperous and satisfactory condition—a result that he thought was due in a great measure to the exertions of Mr. Sydney Hodges, their indefatigable secretary. (Cheers.)

THE ANNUAL MEETING.

Sir Charles Lemon then left the chair, which was taken by Mr. J. J. Rogers.

MECHANICAL DEPARTMENT.

Professor Hunt read the following Report of the Mechanical Committee:—When it is considered that for twenty-seven years the Royal Cornwall Polytechnic Society has been sweeping the county for its efforts of thought, it cannot but be pleasing to its friends to witness the examples which have, this year, been brought before the mechanical committee. Since everything which connects itself with the mining interests of the county must claim the first notice of the society, we must direct attention to some important communications which have been forwarded. One, by a former secretary of the Polytechnic Society, Mr. Thomas Jordan, entitled "A few remarks on the drainage of deep mines, with suggestions for obviating some of the difficulties of the system now in use," is of high importance as directing attention to methods for removing much of the enormous weight which at present exists in the pumps and pump-rods, and for draining deep mines as efficiently as they are now drained, with machinery which, in its first cost, and in its working expenses, will, it is stated by the author, prove to be highly economical. The value of this communication is fully admitted by all the members of the committee who have examined it; since, however, it involves many engineering details, it has been thought important that they should have the advantage of the opinions of the principal Cornish engineers. The paper will undoubtedly be printed in your reports, so that its suggestions may be fully studied by all who are interested in the economical working of our deep mines. Another communication from a Cornishman, now managing agent of the Llandudno Copper Mines in North

Wales, Mr. William Vivian, "On the Applicability of the Microscope to the Study of Mineralogy" is well deserving of careful consideration. The remarks of the author, as derived from his own experience as to the value of the microscope as an agent in aid of mineralogical investigation, are interesting. The author appears in some instances to have imperfectly understood the conditions of crystalline arrangement which he has observed. The suggestions of Mr. Vivian are, however, deemed of such value as to deserve the recognition of the society by the award of the first bronze medal. This award is, however, accompanied by a recommendation that he shall furnish the society with more detailed particulars of his observations than are at present contained in his paper. The importance of attention to many of the natural products of the county which may now be classed as "*waste materials*," cannot be too earnestly enforced. The suggestions, therefore, of Mr. Veall, are in accordance with the desires of the society, who have accepted the offer of Mr. John Arthur Phillips to draw attention to the subject, by delivering a lecture "on the utilization of waste products." There is no one subject of greater interest than the means of uniting the old and the new worlds by means of an electrical channel. It is, therefore, with much gratification that your committee have awarded a first class silver medal to Mr. Hearder for his paper, accompanied by specimens of an electric cable, which, by its arrangements are stated by him to obviate the difficulties which have hitherto arisen from the action of the induced electrical currents. By the cable, specimens of which are exhibited, Mr. Hearder states he obtains increased conducting capacity—perfect insulation—diminished susceptibility of inductive action, mechanical strength and lightness, with perfect facility of recovering after immersion. The paper communicated by the inventor appears to establish, as far as your committee have the power of judging, without direct experimental evidence, the correctness of some of his conclusions. Mr. J. Bickle has forwarded several instruments exhibiting great ingenuity in construction, considerable knowledge of mechanics, and of electrical science, together with much mechanical skill. His electrical clock, arranged for showing the hours of day and night, moon's age and phase, together with the time of high water at the principal ports in the kingdom, especially demanded the recognition of the society, and they therefore awarded him their second class silver medal, together with a prize of 10s. for the clever construction of his imitation of Chinese balls. Some simple and inexpensive surveying instruments have been forwarded. To Mr. W. Bond a first-class bronze medal has been awarded for his simple surveyor's level, which combines with cheapness many points of practical utility. To this exhibitor £1 10s. has also been awarded for his improved locks and cupboard fasteners. A pocket compass with sight vanes for taking angles and bearings, and variation of the compass, with a clynometor combined, by Mr. T. Coad, includes so many useful conditions, that the society has awarded him the prize of £2. Two models have been forwarded by Mr. J. Maynard, one exhibiting a plan for preventing steam boiler explosions, and the other a new method of coaling so as to prevent smoke. These have had the attentive consideration of the committee; they exhibit on the part of the inventor, much thought, and some originality, but since, in the opinion of practical engineers, the advantages are not so great as the inventor supposes, the society cannot consistently do more than record their desire to encourage all such efforts as these, by awarding a prize of £2, coupled with this intimation, that the committee hope to examine, at some future exhibitions, yet more matured efforts of mechanical ingenuity from this exhibitor. To A. and E. Paull, who have submitted to the judges a model of a steam boiler, which includes a novel arrangement of the fire bars—to afford facilities for coaling by means of a hopper placed above the boiler, and a method of superheating steam, a prize of £2 has been awarded. The arrangements indicate much ingenuity and thought, and the model is therefore deserving of commendation, although the value of the plans suggested appear to be of somewhat doubtful utility. The model of the skip with safety-catch, which is employed with great advantage at South Wheal

Frances, deserves careful consideration by the mining community. This safety-skip has been working for eight months to the depth of 150 fathoms in an irregular shaft at South Wheal Frances, and the miners are lowered to or raised from their work with great rapidity and safety, being, of course, relieved from all fatigue. The skip is worked with wire rope, which answers admirably here, the precaution having been taken to employ a large drum on which to wind it, and a large pulley, over which it runs. A drawing of a plan for preventing the overwinding of the skip rope in mines was submitted to our attention. It is one of several plans which are employed in the collieries of South Staffordshire. The committee do not feel that they have been furnished with sufficient information as to its value over other plans, and they can therefore only mention this contribution from a distance, as exhibiting considerable ingenuity. It must be obvious to all persons who are at at all acquainted with the printing-press, that great advantages would be derived from the introduction of presses which should print by bringing the platten directly down on the type, which is retained on an immovable table. This appears to have been effected by an ingenious arrangement, the invention of Mr. William Tregaskis. From the original model, which was in many respects mechanically defective, Mr. Coad has made a small working model printing-press, in which the difficulties appear to be overcome by some ingenious arrangement; and the committee feel that they shall be doing justice to both parties by awarding to Mr. William Tregaskis the first bronze medal, and £3 to Mr. Coad. A mitreing tool for plasterers, also the invention of Mr. Coad, possesses great merit, and certainly must effect a saving of labour, and secure at the same time neatness of work; to this also the prize of £3 has been awarded. Mr. John Gray, of Liverpool, has forwarded his floating compass, which is kept in a state of suspension in water. This arrangement is stated to obviate many of the difficulties which are experienced on board of iron steam ships. The magnetic binnacle and the apparatus for correction of compasses, is stated by Captain Close, of H.M.S. "Trident," in his report, to prevent the influence of the ship's iron on the needle in a satisfactory manner. The first bronze medal has, therefore, been awarded to Mr. Gray, for his improvements. To Mr. George Gibson Brown, of Deptford, a first bronze medal has also been awarded, for his patent gravity binnacle, in which great freedom from vibration has been secured by very simple means. To Taylor's patent steam winch, of which a very beautiful model has been forwarded, the society's second silver medal has been awarded. Amongst the articles sent from a distance, we must name with commendation the registered adjustable vice, from Messrs. J. Walters and Co., Sheffield, and the patent stereoscope, for obviating the convergence of the perpendicular lines of a photographic picture. Bull's patent despatch box, which is made with double sides acting as air chambers, and fitted with vulcanized India rubber, so that when closed no water can gain admission to the interior, appears to be of great value to all persons having to take important papers with them to sea, since the despatch box may be thrown overboard under any circumstances of distress. It will then float until it is recovered, and it may indeed be used as a temporary floating buoy, by the owner, in any case of emergency. To this a second-class silver medal has been awarded. Two models of steam-engines, one of a rotatory engine, by Mr. W. Stephens, and the other of a simple form of high pressure engine by Mr. James Jordan, of London, as examples of workmanship are exceedingly creditable to the exhibitors, and to each a prize of £2 has been awarded. To a model of an arrangement for winding at the Morro Velho Mines, in Brazil, by Mr. W. Goyen, a second silver medal has been adjudged. The adjustments are ingenious, and we have the evidence before us, showing that in the Morro Velho Mines its use has been attended with great saving; still we cannot but doubt if the arrangement can be made applicable to any existing Cornish mines. It may, however, be well worthy of the attention of our engineers, as there are some lodes—such as those of the Perran iron mines, for example—upon which the arrangement may possibly be applied with advantage. A 10s. prize has also been given to Mr. Goyen, for a specimen of turning. To Mr. Learwood, a prize of £5 has been awarded, for his ingenious inventions in the construction of artificial limbs. The testimonials which have been placed before the judges concur in showing that Mr. Learwood has rendered most valuable assistance to several who have had the misfortune to lose a limb. The second silver medal has been awarded to Mr. Lanyon for the manufacture of saltpetre; as a chemical manufacture introduced for the first time into this county, the society desires to mark its feeling as to the value of the introduction of new industries into Cornwall. A drawing of an improved wheelbarrow by Mr. N. Sibley receives a prize of £1; and a cowl head to prevent smoke, by J. H. Bullocke, a prize of £2; and a potatoe steamer, invented also by this exhibitor, a prize of £1. To a set of wigs exhibited by Mr. Williams, Plymouth, which appear in lightness and adjustibility to possess many advantages, the society's second bronze medal has been awarded. Two examples of wood carving with a common pocket knife, and watches and chains, by J. Medlyn, a boy on a farm, a prize of 7s. 6d. has been given as an encouragement for industry; the judges would, however, desire to see it applied to some more useful object. A prize of £2 has been given to W. Owld, a sailor, for a violin manufactured by himself. The judges in this department feel that they should not be doing justice, did they not direct especial attention to the magnetic observations made by Mr. Robert Were Fox during a tour through Italy. The tabulated results are indeed a valuable contribution to science, from one who has been amongst the foremost of the philosophers who have extended our knowledge of the laws which regulate terrestrial magnetism.

Subsequently Mr. Hunt said that he was sorry to find he had made two omissions in this department—namely, Mr. Davey's blasting powder, and the admirable specimens of granite manufacture contributed by Messrs. Freeman. Blasting powder was extensively employed in the county, and the advantage of Mr. Davey's powder consisted in the fact, that the materials employed in the manufacture of gunpowder were combined with another substance which had the effect of causing all the ingredients to be consumed at once, a result that was not obtained in the case of ordinary blasting powder. In addition to this, a saving of one-third in weight was effected, which was no unimportant consideration. A person could not go into any part of England without seeing specimens of the manufactures from the beautiful stones abounding in Cornwall. The serpentine, as they were aware, had found its way into the palatial buildings of London; but it had been found difficult to procure granite in the county which would take a high polish, and the granite of Aberdeen had been employed when this was necessary. It was, therefore, with pleasure that he had seen the beautiful specimens in the hall which had been sent by Messrs. Freeman, and which exceeded anything of the kind ever before presented to his notice. (Cheers.)

Judges.—Messrs. R. R. Broad, R. W. Fox, A. Fox, R. Hunt, J. Hocking, M. Loam, J. Pool, J. Sims, T. H. Tilly.

Improved parallel printing press, W. Tregaskis, first bronze medal—and £3 to T. Coad for workmanship; mitreing tool for plasterers, T. Coad, £3; patent floating ship's compass, Mr. J. Gray, Liverpool, first bronze medal; imitation of Chinese ball, Mr. J. Bickle, Hayle, 10s.; electric clock, J. Bickle, second silver medal; improved scalp wigs, Mr. J. D. Williams, Plymouth, first bronze; drawing of improved wheelbarrow, Mr. N. Sibley, Bodmin, £1; improved gravity binnacle and ships compass, (combined), Mr. G. Brown, Deptford, first bronze; improved method of preventing boiler explosions, Mr. J. Maynard, £1; plan for economising fuel in steam boilers and method of coaling to prevent smoke in ditto, J. Maynard, £1; patent despatch box, C. Bull, Esq., second silver; model of boiler with apparatus for superheating steam, A. and E. Paul, £2; simple surveying level, Mr. W. Bond, first bronze; improved plain fastener for cupboard doors and spindled rim lock, W. Bond, £1 10s.; improved artificial arm for amputation above the elbow, fitted with spring thumb for holding fork, books, &c., also rotatory motions in wrist, and to swing like the natural arm, and new adjustment in shoulder, T. Learwood, Truro, £5; model of steam engine, Mr. J. Jordan, £2; cowl head to prevent smoke in chimneys, J. H. Bullocke, £2; improved potatoe steamer, J. H. Bullocke, £1; violin, W. Owld, 15s.; pocket compass for taking heights of objects, inclination and horizontal bearing of strata, lodes, &c., T. Coad, £2; hydraulic pen for general use of writers, stenographers, mechanical draughtsmen, &c., &c., Captain Ross, R.B.H.A., second bronze; submarine telegraph cable to obviate the effects of induction, Mr. J. N. Hearder, first silver; specimens of crystallized saltpetre, sal prunella, Mr. J. R. Lanyon, Kennal Vale, second silver, model of rotatory engine, W. Stevens, £2 ; two models of watch and chain in wood, carved with a pocket knife, J. Medlyn (15), 7s. 6d. ; model of winding engine in use at Morro Velho Mines, Captain W. Goyen, second silver ; specimens of turning, W. Goyen, 10s. ; model of steam winch, James Taylor and Co., Birkenhead, second silver.

The CHAIRMAN invited remarks from any gentleman in the hall upon any portion of the mechanical department, but no one responded to the invitation.

FINE ARTS DEPARTMENT.

The Rev. T. PHILLPOTTS, the Chairman of the Committee of the Fine Arts Department, then read the following report :—

Your committee have much pleasure in reporting that the exhibition of the present year may well be considered as satisfactory. Although it cannot be expected that the highest standard of excellence should always be maintained—indeed, the limited district, within which competition is necessarily restricted, precludes the hope of a very brilliant display in each succeeding year—still, the walls of this room afford sufficient proofs of the existence of creditable industry, and of a desire for improvement, which, we may well hope, will one day ripen into fruits still more encouraging. The great difficulty which the society has always felt, in this branch of her exhibition, is, and must always be, to award such prizes as are commensurate with the importance of the works exhibited. In the present year, with very few exceptions, the most careful study as well as the nicest taste have been displayed in drawings of plants and flowers—some of these deserve very high credit in their class. The sunny shores of Italy have tempted three of our fair exhibitors to exercise their talents in the delineation of the beauties of nature, and the success which has crowned their efforts will, we hope, induce them to persevere in their native land, and favour us with still further proofs of their taste and skill. In what must be considered the higher class of art, the study of the human form, your committee have again to lament the almost entire absence of specimens worthy of observation. One exception, however, there is, most creditable to the artist, to which attention should be drawn, viz., No. 203, "Ecce Homo," a highly finished copy from the celebrated picture in the National Gallery, by Guido Reni, in which the deep feeling of the original, and the harmonious tone of colour have been most happily rendered. To this picture has been awarded the highest prize ordinarily given to a copy. The first silver medal has been awarded with great pleasure to No. 217, by a native artist, a sawyer of Truro, hitherto self-taught, whose work on the present occasion displays such remarkable improvement on any of his previous productions, that your committee think they are not too sanguine in predicting a very high degree of success in his future career. Happily, he has met with a patron, who has enabled him to pursue his studies under more favourable auspices, the result of which will, it is hoped, be seen in increased progress and accurate persevering study, without which the highest genius cannot command success. Perhaps the most interesting, as well as the most promising branch of our exhibition will be found in the works of the different schools of design recently established in various parts of the county. The schools are at Penzance, Truro, and Redruth; and it has been thought desirable that their productions should be classed separately from other works of art, both because their subjects are different in kind, and because another standard of merit is perhaps necessary with reference to them. They consist of oil paintings, water-colour drawings, both from nature and from the flat, finished crayon and pencil drawings, and outlines. That in oil, of vases and of fruit, No. 224, from Truro, is commended rather as a specimen of careful study of the play of light upon surfaces which are varied in form and colour, than as exhibiting all the qualities which an oil painting should possess. Nos. 228 and 230 are highly creditable groups of flowers drawn in colour from nature by a pupil of the school of Penzance; and 231 is a specimen of the same pupil's earlier work in mere outline. A second pupil of the Penzance school exhibits a highly commendable sepia drawing, No. 232, which is very truthful in the characteristics of the tree, and artistic in effect. No one who looks at this drawing, from nature, of a simple twig of beech, will doubt how much care and diligence can accomplish in forming the taste, and in the development of talent. No. 277 is also an excellent specimen of effective shading of vases in crayon; 279 is good for evenness and care in execution of a difficult piece of outline pattern; and 239, a good copy of coloured design from flowers. Another pupil of the Penzance school, No. 282, has also a good specimen of pencil outline, and a brilliant crayon copy of a highly finished drawing from a cast, 276. Another copy of the same cast, 268, by a different hand, of the Truro school, deserves notice, and it will be interesting to students to compare the executions of these two copies. No. 278 is the work of a pupil of the Penzance school, who has made good use of the short time he has been in the school, the drawing of the lion's head being bold and effective; the same hand appears in colour in No. 239. No. 222, three heads of foxglove, from Redruth, coloured from nature, in which the delicate texture of the flower is very happily represented. No. 225 and 238 are two coloured drawings from the flat, of the *Torrenia Asiatica*, the former from Truro, the latter from Penzance, each carefully and accurately drawn, though one is more delicately, and the other more richly coloured. Nos. 220 and 221 are excellent groups of flowers arranged and coloured from nature, by two different hands, and of such equal merit that it is difficult to decide between them. Perhaps the colour is not quite so pure in the former as in the latter specimen. It is to be regretted that No. 289 is the only specimen of such work, viz., an accurate outline of a muscular human figure from the cast. Many of these productions would do credit to any school of art in the kingdom, and they show that a refinement of feeling and an appreciation of pure style in art are becoming more generally diffused in the county by means of these schools. It is hoped that they will continue to send such objects to the hall in future years, and thus do their best in advancing civilization, by holding up examples of good work from approved models. With regard to the many objects of interest supplied for exhibition only by friends of the society, it would be invidious to select any one of superior excellence. Suffice it to say, that there is much to gratify the taste of the connoisseur, as well as to satisfy the eye of the most casual observer. The best thanks of the society are due to these kind exhibitors. The works of professional artists are, as usual, many and varied. Some pictures by Mr. Philp, which have already earned the praises of the London press, show that he does not neglect the society, to which he has so often contributed. Mr. Hart also exhibits three landscapes of more than his usual merit; while our active secretary, Mr. Sydney Hodges, has added to his reputation as a portrait painter by the fine picture of Colonel Fenwick, the head of which may well be studied as a work of no common merit. There is also another picture, of melancholy interest, by the same artist, painted as a memorial of one who, having long been among the foremost supporters of this, as of all other county societies, has gone to his rest, lamented and honoured by all who had the happiness of his acquaintance, or had come within the range of his benevolent spirit.

Mr. Phillpotts observed, while reading that part of the report referring to the contributions sent by the Schools of Design, that he was happy to learn a fourth school had recently been established at Falmouth, and that in a short time its pupils would send works to the exhibitions of the society with a good prospect of success.

Mr. Sydney Hodges read the list of prizes in this department:—

Judges.—Mr. D. Barclay, Rev. C. W. Carlyon, Rev. T. Phillpotts, Mr. J. J. Rogers, M.P., Rev. R. F. B. Rickard, Miss Christiana Hustler.

St. Gluvias Church, J. A. Coombe, Penryn, 10s.; copy of Guido's Ecce Homo, Miss E. Dunn, Truro, second silver; Cascade at Terni, Miss A. M. Fox, first bronze; Water Colour Landscape, Mr. H. Harvey, Truro, second bronze; Madonna del Seggiola, after Raphael, Miss M. L. Scott, Plymouth, £1; View on the Thames from Blackwall, W. R. Lenderyou, sawyer, Truro, first silver; Water Colour Landscape, Mr. J. Squire, Truro, second silver; Flowers from Nature, Miss Hocking, Redruth, £1; Flowers from Nature, Miss Reynolds, Redruth, 10s.; Original Water Colour, Wild Fox Glove, Miss Hocking, Redruth, special premium, No. 4, £1; Blackberries, Miss Hocking, Redruth, honourable mention; Oil Painting, Still Life, Miss Jenkins, Truro, £1; Flowers, Mrs. R. Bell, 10s.; Jar

of Fruit, Flowers, and Apple Blossom, R. Pentreath, Penzance, first bronze; Sepia Drawing from Nature, S. Thomas, Penzance, first bronze; Copy of Murillo, Miss A. Tregelles, honorable mention; Painting on China, Mrs. B. Gould, first bronze; Water Colour Briony from Nature, Mr. A. L. Fox, first bronze; Water Colour Landscape, J. Knight, £1; Six Water Colour Drawings of Flowers, Mis G. M. Gregor, first bronze; Original Designs, illustrative of Jane Taylor's Essays in Rhyme, J. Shelley, Plymouth, 5s.; Six Outlines, Miss C. Vyvyan, £1, special premium No. 8; Crayon Drawing, Miss Jenkins, Truro, 5s.; Outline from Cast, F. Treweeke, 5s.; Outlines of British Ferns, Miss H. Fox, special premium No. 6, 15s.; Outlines of Flowers, Miss L. Fox, special premium No. 2, 7s. 6d.; Shading from Cast, A. Purchase, 10s.; Outlines from Cast and Nature, S. Thomas, 15s.; Book of Photographs, Rev. F. E. Gutteres, first bronze; Pharaoh's Horses, Miss J. Gatley, second bronze; Illustrations of "Kate Coventry," Miss Mansell, £1; Chalk Drawing from Cast, G. Petherick, 10s.; Sketches from Nature, Miss Vigurs, 10s.; Wild Flowers, sketched from Nature, and classified, Miss B. Squire, £1; Wild Flowers of Nice, Miss S. L. Fox, Lindon, first bronze; specimens of Painted China, Miss Hocking, Falmouth, second bronze.

SCHOOL PRODUCTIONS.

The Rev. S. Rogers read the report in this department, which was as follows:—The judges are glad to report improvement in the school productions manifested in the careful study of nature, as seen in numbers 360 and 362, to which they award their best prizes for original water colour and pencil drawings. The truthfulness of the lichen-covered rock and sea, in the former, give much promise of future success, considering the youth of the artist. They also observe improvement in accuracy and freedom of drawing, and also in choice of subjects, resulting in great measure, they believe, from the teaching of the schools of design. They are much pleased with a head of a horse in crayon, by a child of only eight years of age.

***Judges.*—Miss A. M. Fox, Mrs. Genn, Miss C. Hustler, Rev. S. Rogers.**

Book of Pencil Drawings, J. Spargo, Wesleyan School, Penryn, 2s. 6d.; Pencil Drawings, E. Davey, Wesleyan School, Penryn, 2s. 6d.; View of Old Palace, Lostwithiel, F. Stephens, Kingdon House Academy, 5s.; Book of Outlines, J. F. Gloyne, Penryn, 2s. 6d.; Head of Horse, crayon, Miss Bessie Heard, Truro, 10s.; four sheets of Outlines, W. J. Williams, Helston School, 5s.; three Drawing-books, Miss M. L. Carlyon, Truro, 10s.; thirty-four Pencil Outlines, Boys of Central School, Truro, 5s.; Pencil Outlines, Girls of Central School, Truro, 5s.;

Holiday Sketches, J. H. Barclay, 2s. 6d.; Drawing-book, J. Barclay, 2s. 6d.; Pencil Drawings, Boys of Redruth National School, 2s. 6d.; Coast View under Pennance, W. J. Hocking, 7s. 6d.; View in North Wales, T. Hallamore, 5s.; Bar Mill, Falmouth, G. C. Fox, 5s.; View on Penryn River, R. Gloyne, 5s.; View from Pennance Point, E. C. Hocking, 15s.; Coast View near Swanpool, B. Strongman, 7s. 6d.; Pendennis Castle, from Pennance Point, C. W. Pengelley, 7s. 6d.; Honeysuckle, T. Kelley, Truro, 2s. 6d.; Map of Cornwall, J. Bowden, Liskeard British School, 3s.; Map Ireland, F. Crago, Liskeard British School, 3s. 6d.; Map of Cornwall, P. Bryant, Liskeard British School, 3s. 6d.; Map of England and Wales, J. Gill, Central School, Truro, 2s. 6d.; Specimens of plain Writing and Printing, G. R. Turner, Falmouth, 7s. 6d.; Plain Writing and Printing, G. H. Fox, 10s.; Specimens of Writing, W. Glasson, Redruth, 7s. 6d.; Map of Cornwall, R. Nettell, Trevarth School, 10s.; Specimens of plain Writing and Printing, J. F. Gloyne and J. W. Stephens, Penryn British School, each 2s. 6d.; Map of Europe, G. H. Uren, St. Erth National School, 5s.; Map of British Isles, W. J. Trevaskis, St. Erth National School, 2s. 6d.; Map of the Land of Promise, T. Trevaskis, St. Erth National School, 2s. 6d.; Specimens of Writing, Boys of Central School, Truro, 4s.; cross section of Lodes in Wheal Uny and other Mines, James Rowe, jr., Camborne, 5s.; Drawing of Engine, J. V. Jeffrey, 7s. 6d.; Drawing of engineer's Shaping Machine, W. Glasson, Redruth, 7s. 6d.; Drawing of double action Steam Engine, E. Kitto, Redruth, 5s.; Drawing of Locomotive Engine, A. Vivian, 5s.; Drawing of Passenger and Luggage Train, T. Chatten, 10s.

NATURAL HISTORY DEPARTMENT.

The report of the judges in this department was read by Dr. W. K. Bullmore, as follows:—

At the exhibition of last year, a regret was expressed by the judges in the natural history department, that the various subjects brought before them for adjudication were not of a more practical nature, and it was suggested that the attention of young naturalists more particularly should be directed to the study of certain genera in preference to the mere collection and tabular arrangement of indiscriminate species. To collect and arrange is laudable as a work of industry, and must tend to develope a taste for scientific investigation; but, if the student of nature contents himself with having advanced thus far, he has, as yet, done but little for his own individual improvement, or for the benefit of society at large. It has ever been the object of the society to encourage, as far as possible, closer attention, and more patient investigation of some of the different families so commonly met with in our every day walks. There can be few subjects of study, for example, more interesting than the mallifera, or honey bees; for whether their produce be looked upon as an exemplification of architectural design, or as the effect of untiring industry, we are bound to allow that these tiny insects teach us a lesson which man with all his boasted intellectual powers, would do well to imitate; and the judges would direct the attention of all classes to this interesting and productive class of animals. It is pleasing to observe that the suggestion offered by the judges last year, has been favourably received, and that a large amount of undivided attention has been directed to the study of several important classes of the animal and vegetable kingdom, and amongst these I may mention a valuable monograph by Mr. Jonathan Couch, of Polperro, on the salmon tribe; a monograph on the sphingidæ, by Master W. C. Squire; and in the vegetable kingdom two most valuable collections of the families cyperaceæ and gramineæ. No 441, are four pans of actiniaæ, by Miss Mary Vigurs, to which the society has awarded the first bronze medal. The judges are unanimous in their appreciation of the industry which has collected, and the constant care which has watched over, the health and lives of creatures so frail and beautiful, and consider that this tiny family reflects great credit on their watchful and attentive preserver. No. 442, are five cases of stuffed birds, and one of animals, by Mr. J. Jennings, of Penryn, to which has been awarded 10s. No. 444, is a case containing the natural order sphingidæ, with a monograph on the habits and peculiarities of this genus, by Master W. C. Squire, to which has been awarded 25s. This may be considered a most praiseworthy effort on the part of one so young, and we were pleased to observe that with the exception of two species, which are very scarce indeed, this family of fifteen is quite complete. No. 445, is a case of stuffed birds. No. 446, a stuffed fox and fowl, by Mr. J. Couch, to which has been awarded 5s. No. 447, a calendar of nature, by Master W. L. Fox, to which has been awarded 5s. No. 448, is a beautiful collection of cyperaceæ andgramineæ, by the Rev. Saltren Rogers, which have been dried, mounted, and arranged in the most perfect manner, to which the society has awarded the second silver medal; at the same time they beg to express a hope that he will continue to prosecute his researches in this department of natural history, for which he has given evidence of being so eminently qualified. No. 449, is a case of moths and butterflies, by Master J. H. Barclay, to which has been awarded 2s. 6d. No. 450, is a case containing some beautiful specimens of silk, by Miss A. Miller, to which have been awarded 5s. No. 457, are twenty-one cases of stuffed birds and animals, by Mr. Philip Chapman, to which has been awarded the second bronze medal. No. 459, is a book of dried grasses, by Mr. W. Hockin, of Truro, to which has been awarded £1. No. 460, is a monograph on the salmonidæ, by a very frequent and much valued contributor, Jonathan Couch, Esq., to which has been awarded the second silver medal. No. 461, is a contribution to the fauna of Falmouth, by the society's never-failing friend and auxiliary, W. P. Cocks, Esq. The judges have read his remarks with much pleasure, and are of opinion that they sustain his reputation as one of the most accomplished naturalists that this county has ever produced. They much regret that his feeble health has deprived them of his valuable opinion in the consideration of the objects submitted to them for adjudication, and they beg to tender him their most cordial thanks for his present valuable contribution. In conclusion, there is one other subject to which they would draw attention, and that is to a rare and interesting bird on the natural history table, kindly sent for exhibition by S. Gurney, Esq., one of the members for this place. It is named the apteryx, and was, it appears, first discovered in New Zealand. In form it resembles the penguin, but many of the peculiarities about it seem to separate it widely from this bird. In the first place, the feathers have no accessory plumes, and their shafts are prolonged beyond the barb. The bones, unlike those of birds generally, are not hollow, and have no communication whatever with the lungs. It differs, too, in the completeness of its diaphragm, and in the absence of abdominal air cells, and its wings are in a more rudimentary form, reduced to two small stumps, terminated by a small hook. It subsists on insects, runs with great activity, and when attacked, defends itself most vigorously with its feet. On the whole, the judges in this department are pleased to observe that the most marked improvement has taken place both in the quantity and quality of the subjects offered for competition, and hope that those who have done so well on the present occasion, may be induced to continue their efforts, and that the labourers in this interesting department of natural science may come forward and contribute to the exhibition of 1860.

Judges.—Messrs. H. C. Bastian, F. C. Bullmore, W. K. Bullmore, Rev. Wm. Rogers, Messrs. N. Tresidder, and R. C. Vigurs.

NAVAL ARCHITECTURE.

Mr. Swatman read the following report of the judges:—

We have to report that, although the number of exhibitors in this branch is not great, yet there are some contributors deserving of special notice, and to whom prizes have been awarded as follows:—A well-executed design for an ocean steamer, J. Knight, Devonport, £1 10s. A neatly executed half model of a brig, sails cut out of wood, W. H. Kessell, 15s. Half model of a brig sails cut out of wood and model of a yacht, being good models, and of good workmanship, C. Gill, £1 10s. Fine model of a schooner, J. H. Bullocke, £1. Model of a screw line-of-battle ship, R. Hancock, Devonport, £2. New method of calculating tonnage, W. Harvey, Devonport: no award, the plan not considered to be practically useful. Wood's boat suspending and detaching apparatus: a very ingenious contrivance, but it does not appear to be equal to Clifford's boat lowering apparatus, exhibited last year.

Judges.—Mr. F. Swatman, Mr. Bradfield, Capt. Eden, R.N., Capt. Robinson, R.N., Capt. Rogers, R.N., and Capt. Wodehouse. R.N.

STATISTICAL DEPARTMENT.

The chairman said that in the absence of the chairman of the committee in this department, he would read the report:—The only contribution to this department this year is a continuation of Mr. R. Q. Couch's valuable paper of last year on the mortality of miners, embracing this year the district of St. Ives and the agricultural district of St. Buryan. On this subject, Dr. Barham writes as follows to the secretary, Mr. S. Hodges:—"Dear sir, I fear I may have put you to inconvenience by not having returned this paper earlier; but I could not possibly look through it until this afternoon. Mr. Couch appears to me to be equally deserving of whatever testimonial the Polytechnic Society may have to bestow on such labours on this occasion, as in former years. The results of his inquiries are alike conclusive and important, and they certainly demand renewed attention to whatever may be practicable in mitigation of the mortality of our miners."

Prize.—Essay on the mortality of Miners in the district of St. Ives and the Agricultural district of Buryan, by Mr. R. Q. Couch, M.R.C.S., &c., Penzance; second silver medal.

Judges.—Dr. Barham, S. T. Fox, M.R.C.S.

PLAIN AND FANCY WORK.

No report was presented in this department, but Mr. S. Hodges read the following list of prizes:—Vessels in needlework, W. Scantlebury, Falmouth, honourable mention. Embroidery, S. H. Gloyn, Penryn, 5s. Vessel in needlework, C. Rickard, 7s. 6d. Pair of screens, Miss Dyke, Carclew, 5s. Patchwork quilt, Grace Savory, 7s. Hearthrug of rags, H. Coome, 7s. 6d. Shirt, S. Williams, Falmouth, (special premium) 7s. 6d. Ships in wool-work, including H.M.S. "Russell," J. Sye, honourable mention. Two framed pictures of Messrs. Baring and Gurney, and ornamented in leather work, Miss Bell, £1. Pair of knitted worsted socks, C. Stephens, 5s. Vessels in worsted work, F. Denton, 7s. 6d. Anti-Macassar and three collars, in tatting, Mrs. Edsall, Truro, 5s.

Judges.—Miss Rogers, Miss M. Vigurs, Miss. S. Rogers.

INSTRUCTION OF THE BLIND.

After the reading of the judges' reports, the second annual meeting of the supporters and friends of the scheme for the itinerant teaching of the blind in this county to read the Holy Scriptures by means of the raised type, on Moon's system, and to write, was held in the committee room, Mr. John Jope Rogers, M.P., of Penrose, in the chair. After a brief introduction from the Chairman, the report for the past year was read by the Secretary, the Rev. Edward Tippett, which, it was resolved, on the motion of Mr. R. W. Fox, seconded by the Rev. Thomas Phillpotts, should be printed and circulated among the subscribers and others, with the hope of creating a more extensive interest in the undertaking. It was pleasing to observe that the attendance at the meeting exceeded that of last year.

LECTURE.

At half-past five o'clock, Professor R. Hunt delivered the first of the lectures arranged to be given at this meeting of the society, to a large and highly-interested auditory:—Subject, "Some recent investigations in light and colour."

Mr. Hunt commenced his lecture by alluding to several new dyes which had been obtained from the vegetable kingdom, particularly various preparations of indigo, some of which had become very important. He referred to the peculiar green obtained from grass, yellow from buckwheat, and some other hitherto transitory colours which had now been rendered permanent. He then described the new colour, "mauve," which may be obtained from indigo, but which is procured in practice from coal tar. A carbonaceous compound called "aniline," is first obtained by a peculiar process from the refuse of the gas works, and this aniline, which is a colourless fluid, forms salts with many of the acids, and from these salts, when treated with the bichromat of potash and alcohol, the beautiful purples—the mauve—now so fashionable, is obtained. Mr. Hunt next proceeded to explain the philosophy of colour, showing the various methods by which, from the decomposition of white light, coloured light was obtained. The phenomena of inflexion and deflection, as illustrated by Lord Brougham, were explained, and the polarization of light was fully dealt with, the lecturer showing how many colours were the result of this action. The phenomena of fluorescence was also explained, and several other points connected with this abstruse research. Mr. Hunt next directed his attention to some of the more recent and remarkable photographic results, and illustrated his subject by some very beautiful examples of instantaneous photographs, showing the shell in its flight from the mortar, the wave breaking on the shore, and many other remarkable illustrations. The recent investigations of M. Niepce, of St. Victor, received full consideration. These investigations appeared to prove the absorption of light by all bodies, and the development again of light so absorbed, when the bodies were placed in darkness, as sunshine might be actually said to have been retained in a tin case lined with white paper, for a period of six weeks, for at the end of that period, a photograph was actually taken with the imprisoned rays. It was also explained that earth when taken from some depth beneath the surface produced no effect upon highly sensitive papers; but that if the same earth were exposed to the sunshine for half an hour, it would have then acquired the property of blackening these papers in a very remarkable manner. In conclusion, the lecturer proceeded to show the intimate connexion between terrestrial phenomena and the changes in the form of matter taking place in the sun, going to prove that all the physical forces upon which depend terrestrial phenomona are generated in the centre of our system by some mysterious alterations in the form of the matter of which the great mass of the sun is constituted; so that every form of organization is directly dependent upon some peculiar action going on upon the sun's surface. The lecture was highly attractive, and was listened to with great interest.

A vote of thanks was unanimously accorded to Mr. Hunt for his able and interesting lecture.

Mr. Charles Fox then moved, and Mr. R. W. Fox seconded a vote of thanks to Mr. Rogers for his able conduct in the chair on that occasion as well as throughout the day, which was carried by acclamation.

THURSDAY,—SECOND DAY.

The exhibition was opened to the public from ten o'clock this morning till four in the afternoon; and again in the evening, from six till ten. The day was beautifully fine, and the number of visitors was greater than on any previous second day for some years, the attendance amply making up for the slight falling off occasioned by the unfavourable weather of Wednesday. At twelve o'clock Professor Hunt proceeded to explain the principles of several of the models and scientific apparatus exhibited on the tables, Mr. J. J. Rogers, M.P. occupying the chair.

EDUCATION OF MINERS.

At half-past one o'clock a meeting was held in the committee-room, for the purpose of considering the subject of the education of the mining population of this county, particularly in those branches which are more immediately connected with the employment in which they are engaged. Mr. J. J. Rogers again took the chair, and amongst those present were Dr. Barham, (mayor of Truro,) Professor Hunt, Mr. R. W. Fox, Dr. Jago, Mr. R. Pearce, (mayor of Penzance,) Mr. W. H. Jenkins, &c.

A very lengthened discussion then ensued, in which the Chairman, Dr. Barham, Mr. Hunt, Mr. R. W. Fox, Mr. R. Pearce, Mr. Newton and others joined. Several able communications on the subject were read, but as Mr. Hunt has brought the matter so prominently before the county at a subsequent meeting at Camborne, it is not necessary to give a report *in extenso*.

At the conclusion of the meeting, the company adjourned to the hall of the society, when Mr. J. N. Hearder, of Plymouth, delivered a very interesting lecture on the submarine cable. Mr. J. J. Rogers, in the chair.

The lecture was in substance the same as the paper on Submarine Cables, which will be found in another portion of the report. At the conclusion, a vote of thanks was unanimously passed to Mr. Hearder for his instructive and interesting lecture. Shortly before eight o'clock, Mr. Hearder proceeded with his second leture on "Some recent discoveries with a powerful induction coil." He exhibited and explained a powerful induction coil nearly similar to the one for which two years ago he was honoured with the first silver medal of the society; and illustrated its capability by a variety of brilliant experiments. He produced sparks three and four inches long in the air; showed that these sparks were capable of igniting inflammable substances, such as gunpowder, gun cotton, paper, &c.; and caused them to pass through a variety of metallic substances, lead, glass, &c., the partial combustion of which was brilliant and interesting. He next showed the effect of the Leyden jar in combination with the coil, and exhibited the rapidity with which discharges were produced, the light and noise being surprising. Various semi-opaque objects, such as eggs, crystals, &c., were brilliantly illuminated by the passage and discharge of the current. The lecturer exemplified the influence which the pressure of the air has in modifying the appearance of the spark, and showed some very striking experiments in receivers which had been exhausted by the air pump. A brilliant stream of crimson light was produced in a tube more than three feet long; and in another curved tube containing a vacuum with a trace of phosphorus, the appearance of the electric light was variegated according to the atmosphere of the tube, the larger portion appearing green, while the smaller portion was red. He next exhibited a machine which he had invented for registering the number of sparks by means of an arm working by a half-second pendulum, and vibrating over the surface of a paper disc, on which the number of sparks in a second was conveyed. The value of each discharge being known, as well as the number which could be produced in a second, the instrument afforded a right mode of comparing the effects of the induction coil with those of the frictional electrical machine. Mr. Hearder concluded by explaining the application of his induction coil on a very small scale, for the purpose of alleviating pain in the extraction of teeth. He explained the *modus operandi*, and stated that in the hands of a careful operator, though possessing but a very indifferent or imperfect acquaintance with electricity, its application almost invariably ensured success. Such had been its success in Plymouth amongst his immediate friends, that it was no uncommon thing for dentists to extract nine teeth out of ten without causing any pain.

A vote of thanks was unanimously accorded to the lecturer at the conclusion.

THIRD DAY,—FRIDAY.

A water excursion to Carhayes Castle was set down for the afternoon of this day, but, owing to the very unfavourable state of the weather, the rain falling without intermission from morning to night, this had to be abandoned. To compensate for the disappointment, Professor Hunt gave some further explanations of the machinery in the hall, at twelve o'clock. At one o'clock Mr. G. Fox, of Kingsbridge, made some interesting remarks on bees; and an hour later Mr. Sydney Hodges read a paper on the fine arts. The attendance of visitors, however, was only small. In the evening, the number was much greater. Shortly before eight o'clock Mr. J. A. Phillips delivered a very interesting lecture on "Waste Mineral and Metallic Products." Mr. Phillips commenced by pointing out the number of important waste products which are not at present utilized, and enumerated others which are turned to practical purposes, such as old horse-shoe nails and scraps from needle manufactories, which latter are sold by cartloads for making gun barrels. He next described a process by which the tin covering the chippings of tin-plate might be recovered by means of digestion with an alkaline sulphide, and the method by which copper filings and copper scale are fused into ingots by the "sweep washers," and forwarded to Swansea for elaboration by the smelters. He next proceeded to show in what way the former heavy losses by sublimation in lead smelting were now obviated by means of long flues and condensors, illustrated by Mr. Beaumont's lead works near Allenheads, where the flues for condensing the fumes are about seven miles in length, resulting in a saving of £10,000 per annum to the establishment. He stated also, that the sweep washers contract for the ashes of houses destroyed by fire, and abstract quantities of metal by means of sifting. The lecturer, after briefly reverting to numerous other metallic wastes, enumerating among them the waistcoats of goldbeaters, which, after long wear, have been known to fetch almost fabulous prices, adverted to some of the principal mineral waste products, such as mundic, which, thrown away as useless some years ago, has now, by the aid of science, been made to yield large annual returns. He next minutely described a process in operation at Linz, on the Rhine, and other places in Germany, where ores containing only one per cent. of copper are treated with advantage. He stated also, that in the island of Anglesea the sediment formed by precipitating the copper in the water flowing from the mines, was now converted into an excellent pigment, and that nearly all the red ochre used in this country and America is obtained from Anglesea, at about 30s. per ton. The lecturer next described the operation of the roasting kiln and the Castilian furnace, and pointed out the most recent improvements in the process of lead smelting. He mentioned that at Carthagena, in Spain, the Romans had established smelting works, where, as they sought rather after silver than lead, they left large quantities of slag, which had been smelted over again with the very best results. In the Mendip Hills, this had also been the case. Black jack or blende, until a comparatively recent date, had been considered worthless, but within a recent period had become an article of considerable importance in the manufacture of tin. A great quantity of this, he stated, was now sold in Cornwall, as it was found that in addition to the zinc, the blende was found to contain portions of gold, silver, and copper. Wolfram was another substance formerly considered worthless, but is now employed in various ways—amongst others, for making tungstate of lime, which is used for ornaments, as it resembles some kinds of white marble. He next stated that large quantities of cobalt and nickel are wasted and lost, from the fact that few assayers possess a sufficient amount of chemical knowledge to enable them to abstract these from the ores that may be sent them, not having devoted sufficient attention to the subject. In conclusion, the lecturer remarked that it was of vital importance to this country to keep pace with our neighbours on the continent in matters of this kind—that in Germany, where a knowledge of chemistry was more widely diffused, everything was turned to advantage. He hoped that he had been able to direct attention in some degree to this subject. It has been aptly remarked, that the man who makes two blades of grass grow where only one was produced before, not only enriches himself, but is a national benefactor. That truism, though uttered in reference to one particular pursuit, would apply to all branches of our national industry—mining among the rest, and therefore it could not be too prominently kept in remembrance.

The CHAIRMAN in proposing a vote of thanks to Mr. Phillips for his able and instructive lecture, said that they might all congratulate themselves on having amongst them a countryman who was both a scientific and practical man, and who had shown them how many of the mineral products which had hitherto lain neglected, might be converted and rendered of value. He trusted that they should all profit more or less from what they had heard.

The resolution was carried by acclamation.

Mr. PHILLIPS, in acknowledging the compliment, said that he took a great interest in the subject, and being thoroughly impressed with its importance, he should much like to see a larger amount of chemical knowledge diffused throughout the country. It was not necessary that the mining agent or smelter should be an accomplished chemist; but he should possess an eye which would detect ores as soon as they presented themselves, and sufficient chemical knowledge not to attempt impossibilities. He had a small laboratory in the neighbourhood, and if any gentleman was unable to recognise of what any mineral ore or substance which he might find consisted, he should be happy to test it without fee and tell him the result. (Cheers.)

On Saturday, the fourth day, the prices of admission were as usual reduced, and a great number of school children visited the exhibition. In the evening the proceedings of the week terminated with the following highly interesting lecture, kindly delivered by Mr. Osler. The lecturer prefaced the subject by observing that until a comparatively modern period the large first class harbours were neglected, not on account of their remoteness from the capital and difficulty of communication, since Fowey holds a conspicuous place in English history, and Dartmouth was also a considerable port. Yet so lately as 200 years ago, Falmouth and Devonport were not, and Plymouth was a small town of 6,000 inhabitants. The fact was, that so long as the most effective weapon was the bow, whose range was only 240 yards, harbours a mile wide could not be defended, and ports like Fowey and Dartmouth were preferred, which were large and deep enough for the ships of that period, while their narrow entrances flanked by steep hills secured them against an enemy. But as soon as large ships armed with cannon were introduced, then harbours like Falmouth rose to importance. The first ship of the British Navy was the "Great Harry," built in 1488, probably of 500 or 600 tons, and firing her guns over the bulwarks. She seems to have been the ship which in 1511 engaged and captured the famous Scottish corsair, Sir Andrew Barton, of which action we have a very spirited poem, which gives a very good idea of the fight. Some years later, ports were invented, allowing ships to mount more than one tier of guns. In 1515 our first line-of-battle ship was built, the Henri Grace de Dieu a two decker of 1000 tons, and carrying 80 guns. In the reign Henry the VIII., Falmouth Harbour was protected by the castles of Pendennis and St. Mawes, and Pendennis was further strengthened in the reign of Elizabeth by the fortifications around it. How it was distinguished in the Great Rebellion, by affording safe shelter to the Queen and resisting last of all the Parliamentary forces, is matter of history. William III. formed a naval arsenal at Plymouth. It was a question between Plymouth and Falmouth, and the more convenient access to London may be supposed to have decided the choice. The formation of colonies and the extension of commerce in the 17th century, led to an establishment of foreign packets, and the necessity of placing them at a port the readiest of access to the open sea, led to their being stationed at Falmouth, where they remained, with a brief interval of three months in 1810, till 1843, when the necessity of railroad communication led to their present temporary removal. The lecturer noticed the superiority of the packet crews, which he attributed to their being brought up to the service; to the officers and men being all known to each other; to the necessity and value of character; to the facility with which character obtained promotion; and in a very considerable degree, to the trade which the officers and crew carried on, and which, though checked by the revenue officers, was a material and necessary source of profit, and could be carried on only by personal credit. He cited illustrations of their superior seamanship and courage, in the preservation of the crew of the "Lady Hobart," and in actions fought against very superior force. No packet was ever lost in the harbour, or between the harbour and the open sea, though they never waited for daylight or clear weather to enter it. From this fact he inferred the high value of the harbour in point of safety and convenience, especially as no lighthouses existed for the greater part of the period. The accuracy with which the soundings and character of the bottom at the entrance of the Channel are laid down in the charts, enables ships to make their way to Falmouth by the lead. The lecturer cited a race between the "Freeling" packet and a New York liner for a considerable bet across the Atlantic, both starting from New York together, the one for Falmouth the other for Liverpool. They reached the entrance to the Channel together, and then encountered thick fogs. The liner was unable to proceed, but the packet kept her course by the lead and won the race. At the end of the last century and beginning of the present, an export of printed cottons, then almost as costly as silks, was carried on by the Lisbon packets which Mr. Pellew, the collector of the customs at Falmouth estimated at four millions a year. It was irregular and clandestine, but was winked at by the Government in consideration of its great value, till the trade was placed by treaty with Portugal on a settled footing. The employment of the harbour in the first American war by privateers, as a station the most convenient for their object, the success they obtained, and the wanton waste in which their crews indulged to get rid of their prize money was next noticed, as well as the incident of the burning in Carrick Road at this time of a fire-ship full charged with combustibles, which happily drifted on shore, and blew up on the Roseland side of the harbour. The subject then proceeded to the western squadrons, which, from their station at Falmouth, protected the Channel in the earlier part of the great French war; the attempted invasion of Ireland in December, 1796, illustrating the uselessness of an eastern port to meet a danger beyond the mouth of the Channel; the defeat and partial destruction of that armament by tremendous gales, and the perfect safety with which at the same time a fleet of several men of war and transports, and more than 200 sail of merchant ships, rode out the gales in Falmouth. Almost the only service performed against the enemy at that critical period was by cruisers stationed at Falmouth, and which sailed from that port. At the end of 1805, a very stormy winter, in which the Channel Fleet was often blown from its station off Brest, when Plymouth Sound was unsafe, the breakwater not being then made, and Torbay was too far to the eastward, three admirals in succession, Cornwallis, Sir C. Cotton, and Earl St. Vincent, took the fleet for shelter to Falmouth. Lord St. Vincent brought in eight three-deckers at once; three of them, the Hibernia 120, Ville de Paris 112, and San Josef 112, being the three largest ships in the navy. The Government in consequence laid down buoys to mark the channel in Carrick Road, and formed an establishment of naval stores, with two small two-deckers for a sheer hulk and hospital ship, in addition to the ordinary harbour ship, for the convenience of ships requiring the accommodation. In January, 1808, an enormous basking shark passed up the inner harbour, and was left by the ebb tide at Penryn. It was thirty-one and a half feet long, twenty-four feet in girth, and four and a half feet across the mouth. The skin was set up and exhibited through the country, and the owner made it his dwelling, using the mouth for a door, living in the belly, and sleeping in the tail. In this year the Spanish war of independence broke out, and the deputies who came over to ask assistance from England landed at Falmouth. In October, an army of 12,250 men, under Sir D. Baird, was assembled there to strengthen Sir John Moore. They sailed Sunday, October 13th, and entered Corunna on Thursday. At the same hour on Sunday, three transports sailed from Plymouth to join them, of which one reached Falmouth on Tuesday, one on Thursday, and the other put back. So that a large fleet of transports made the passage from Falmouth to Spain while single ships were beating from Plymouth to Falmouth. At the same time two regiments of dragoons were embarked at Portsmouth. They were ready and attempted to sail October 4th, but it was the night of the 1st of November before they passed Falmouth. When it was found necessary a few weeks after to provide for re-embarking the army in Spain, the Spanish armies having all been defeated, and the French concentrated to overwhelm the British, transports were collected at Portsmouth, and at Falmouth. Both convoys sailed on the same day, December 15th; that from Falmouth made its passage, but the Portsmouth convoy was dispersed in a gale two days after, and came straggling into Falmouth in the course of the following week. In October 1810, the vexatious and cruel conduct of the revenue officers on board the packets, who broke open the men's chests, and took from them all their ventures, led the men to come on shore and appeal to the packet agent either for increase of pay, or for a reasonable license to trade. Exaggerated accounts of the disturbance reached the authorities, with the addition that the inhabitants sympathised with the mutineers. The packets were therefore removed to Plymouth in the beginning of November. But it was found that they could not ride safely in the Sound, and could not sail at all times from Hamoaze. On one occasion a packet, for which a king's messenger was waiting, was detained in Hamoaze by an easterly wind, which at the same time was compelling homeward bound packets to put into Falmouth, and after three months the packets were restored. In March, 1812, H.M.S. "Conquestador," 74, grounded on the coast of France, and was brought home in a sinking state by a frigate. A tremendous south-east gale caught them off the Lizard and obliged them to bear up for Falmouth. The tow-ropes parted in the bay, and the 74 was obliged to anchor there and ride out the gale. 100 packets'-men volunteered to relieve the exhausted crew at the pumps, and at the risk of their lives went off in a revenue cutter, and got on board the line-of-battle ship in a gig. At this time, the Government had determined to make Falmouth the general depot for stores and transports for the army in Spain, and with this view to form a dock at Bar, under the castle. But before any step could be taken, the victory at Salamanca, followed by the destruction of the French army in Russia, gave a prospect of a speedy close of the war, and nothing was done. The cavalry for the army had been generally embarked at Falmouth, where ten transports at a time could lie at the different quays, and embark a regiment in an hour. The lecturer then noticed the very few wrecks which have occurred within the harbour for the present century, gave the details, and showed how all had been caused by gross misconduct on the part of the officers in charge. No other great port could boast of the like impunity. At Plymouth, previous to the breakwater, almost every heavy gale had its tale of disasters, and though security has since been afforded to ships anchored under its shelter, yet it does not prevent the sea in violent southerly storms from forming an eddying wash at the bottom of the Sound, which is more destructive than ever. In the gale in 1819, seven vessels were lost, one of them a gun-brig with all her crew, another, a man-of-war schooner, and a third, a packet. In 1824 more than thirty vessels were wrecked together. In 1828, ten; and two years since, a fourth gale blew up the gates of the Great Western Docks. The noble conduct of the inhabitants of Falmouth in relieving the hundreds saved from the burning wreck of the "Kent," Indiaman, was then mentioned. Still more noble was the charity exercised in 1828-9 to a destitute party of 150 German emigrants, who had embarked in an unseaworthy ship which put in for repairs. They were housed, and for many months supported, partly by their work, but chiefly by private and public charity. The additional charge on the rates of the town of Falmouth alone, was no less than £500, and it was met without a murmer. The last fact related was the many vessels which having been tempted to sea from ports to the eastward by a fine day in October, 1833, were caught in a heavy south-east gale with thick weather at night, by which ten of them were lost with their crews on different parts of the coast. It was plain that if a lighthouse had existed at the entrance of Falmouth Harbour, all might have been saved, and this led to the building of St. Anthony's lighthouse in the following summer. The ludicrous mishap which befel the multitudes who assembled in their summer finery from Falmouth, Truro, and the neighbourhood, as to a general holiday, to witness the laying of the first stone, June 4, 1834; and who were caught in a tempest of wind and rain far from shelter, and obliged to flounder through pathless ploughed and hay fields, supplied a farcical close to the lecture. Time would not allow to notice the important events of the last quarter of a century, and the lecturer closed at this point, congratulating the audience on the bright prospects opening for their harbour, in the increasing number of arrivals which made it the port of call for the world, in the near completion of their railway, and the prospect of its being made the great Ocean Telegraph station.

In proposing the thanks of the meeting, the chairman, Mr. Alfred Fox, took occasion to inform the company that the directors of the docks had that day completed an important contract for timber, an announcement which was received with loud cheers.

The drawing of the Art Union prizes was deferred until Monday.

The following is the list of prizes.

Mr. F. Swatman, collector of Customs, Falmouth. £21, selected "An Eye to Windward," by Sydney Hodges. Mr. J. St. Aubyn, M.P., £15, "Penberth

Cove," by Mr. Philp. Mr. T. H. Tilly, £10, "Penvensey Bay," Meadows. Capt. Wodehouse, R.N., £5, "Mullion," J. G. Philp. Mr. John Michell, assayer, Redruth, £5, "Arch Rock, North Coast of Cornwall," J. G. Philp. Mr. W. J. Genn, Falmouth, engraving of "Life at the Sea Side." Mr. Coombs, Penryn, ditto.

Memoir of the Natural History of the Salmon tribe; from Materials chiefly collected in Cornwall and the West of England.

Nec tamen in Medias pelagi te pergere sedes
Admoneam, vastique maris tentare profundam.—OVID.

BY JONATHAN COUCH, F.L.S., &c.

There is no family of fishes of usual occurrence, the natural history of which is so little understood as that of the Salmonidæ, or the Salmon and Trout, and this condition of ignorance on the part of naturalists is the more surprising, as all the species are known to pass their lives at no great distance from places of human resort; and they have long solicited and obtained attention, from the circumstance that from a very distant date they have been regarded as a highly valuable article of food.

It is not a little remarkable also, that the portion of their history which is least clearly understood, is that which is passed in the more immediate neighbourhood of man: a circumstance in great part to be accounted for from the fact that in the earlier stages of the development of the different species, the distinction from one another has not been well made out; and consequently that in those rivers where most of the migratory sorts are found, the experiments which have been instituted for the purpose of tracing their breeding and development, have not been attended with satisfactory results, from an error in the observers, in confounding one species with another: to which in their early growth they bear a likeness not readily to be distinguished.

Another source of mistake has been, that in order to secure a close examination of the individuals selected and artificially marked, the specimens have been placed in a state of unnatural confinement; from which interference with their usual habits, few fishes suffer so severely as the migratory species of Salmonidæ; as well in their shape and colour as their rapidity of growth; so that conclusions drawn under such circumstances cannot be depended on.

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There appear to be some grounds for the belief, that in Cornwall we possess some advantages for settling the uncertainties existing in regard to some portions of the history of this family, from the very fact that they are much less abundant in our rivers than in the deeper and more fertile streams of Scotland; for in the west the species are less mingled together; and indeed while some of the Cornish streams receive some of the species only, other sorts abound in others; and the instances are few, in which, probably from diminution of the water in summer, the upward migration of the salmon is not confined to the season of spawning, which appears to be in all instances in the months of November and December, with perhaps sometimes a week or two in the month of January. Something in this respect will depend on the season, whether it be disposed or not to wet, dry or cold; and this too, not solely from the abundance of water in the river to help them onward, for the salmon shews in a decided manner what is also observed in fishes that inhabit the deeper recesses of the ocean; that they are quickly and deeply sensible of changes in the atmosphere; a circumstance well known and acted on by practical fishermen. A moist and mild condition of the air will draw salmon to the river in large numbers, especially at a time when the tide is rising with a tendency to exuberance.

SALMONIDÆ.

The well-known naturalist Bloch says, that they enter a river from the sea in two ranks, which form two sides of a triangle; that the stoutest fish, which is commonly a female, leads the march, and at about a fathom behind her, are two others, in which order they proceed, with all the others following, and without being turned aside by any ordinary hindrance. According to him the females go first, and next to them the stoutest males; so that if the fishermen begin by catching only small males, they conclude that the chief body has already passed onward. They give preference to the middle of rivers, where they are not deep, unless in boisterous or cold weather; and a rapid river with a clean sandy bottom is a favourite resort. In what numbers they sometimes enter a river may be judged from the fact, that in the Ribble in the year 1750, three thousand five hundred salmon were taken at one haul; and in at least the early part of the present century the enormous number of 35,000 was the average amount of the fishery within a year, in the Scottish river Tay, beside four or five thousand grilse, which are salmon of a younger growth. The quantity of Salmon and Salmon-trout sold in Billingsgate Market in one year was 29,000 boxes, with 14 fish in a box; making 406,000 fish, of the weight of 3,480,000 pounds.*

In the deeper rivers of the north what are termed clean Salmon, which have not the motive of spawning to tempt them into fresh water, are found to begin their ascent early in the year; and numbers of them are passing upward through several of the succeeding months; the season of greatest success in the fishery being in the height of summer. But little of this is known in the west, although in one or two of our more considerable streams this spring-migration has been the subject of attention, and it will again be more particularly referred to.

It has been supposed that the fish which thus leave the sea in the spring, have still the motive of spawning to prompt them, although so long before the natural period; and that they do not return to the sea until this function has been accomplished. But it is no proof of this supposition, that in some rivers of Scotland, and the most northern parts of the continent of Europe, salmon have been known to shed their spawn at Midsummer. This fact can only be regarded as an exception to the general law, and as such has been observed also in many other species of fish, both of salt water and fresh. But it has not been certainly shown that the young brood of this irregular spawning, has ever reached perfection; and it is certain that the life of the embryo is destroyed when the spawn is shed in situations where the tide is able to reach it.

It is not the least curious part of the natural history of this fish, that while in its first development, and until it is of the length of two or three inches, the presence of salt water is

* Mayhew's London Labour.

poison to it; presently afterwards, the circumstances of its nature have become so changed, that a residence in the sea is necessary to its health and growth, which latter is indeed very rapid. In some carefully marked fish, in four months from the time of going to sea and returning, the fry have increased in size from three to seven pounds. From this time a not unfrequent change from one water to the other is practised; but it appears to be with longer intervals in the west than in the north.

Whether the salmon could bear perpetual confinement to the sea any more than to the river, is uncertain; but it is the opinion of careful observers, that in apparent opposition to its powerful instincts its entrance into fresh water has a certain and speedy influence in lowering its health and well-being, both of which can only be brought back by a return to the sea.

In the rivers of Cornwall and Devon the ascent of the Salmon in the months of March, April, and May is not productive of benefit to the fisherman, since, professedly to protect such salmon as have spawned, and are descending the stream towards the sea, the laws forbid the fishing for them or exposing them for sale. Yet a good reason can scarcely be assigned for this prohibition; and it is certain that salmon in every respect good for food are thus left uncaught. It was with some impression of this, that in the year 1858, an application was made to the Justices at the Quarter Sessions, that so far as regarded the river Camel, the fence days for the taking of Salmon might be changed from, as at present, between the 23rd of December and the 15th of May, to the first day of March, and ending the first day of June; on the plea, that in the months of January and February a particular and superior sort of salmon, locally called the Blue Pol, or Candlemas Shoal, is met with there, and at no other time of the year; which shoal is lost, by coming into the river within the time of the usual fence months. The court refused to grant this application, on the ground that due notice had not been given of the intention to apply for the permission required; but it might also have been rejected on more solid grounds, and a magistrate is reported to have remarked, that the fish termed the Blue Pol is no peculiar sort of salmon, as differing essentially from others. And it is worthy of notice how uncertain is the language that often prevails in regard to the varieties in which this, as other kinds of fishes, is known to sport. In the examination of a professed fisherman before a Committee of Parliament on the salmon fisheries in the year 1825, he expresses his belief in the existence of many species of salmon, and on being pressed to explain himself, he gave, as well in proof of the fact, as in illustration of his meaning, the instance of the various species there are known to be of horses.

The value which at a very early date in our Natural History was set on the salmon, is shown by the fact that in the law called the Second Statute of Westminster, which is again recited and specifically confirmed by another, the 13th of Edward I., (St. 1, Cap. 47.) it is enacted, that young salmon shall not be taken or destroyed by nets or other engines, at mill-dams, from the middle of April to the nativity of John the Baptist, which, therefore, is the first fence or close time mentioned in our law; but this confirmation by Edward adds that young salmon (lampreys) shall not be taken by any hurtful nets at any time. The first-named statute also fixes fence days for salmon in general, from the day of the nativity of our Lady until St. Martin's day.

The new act of Edward, added special fence days for the rivers Lon, Wyre, Mersee, and Rybbyl, for Salmon, from Michaelmas to the purification of our Lady. How needful this forbidding of the taking of young salmon was, will appear from the fact that, by a petition to the King, (Edw. III., A.D. 1376,) it is represented that the salmon fry were taken by engines, for the purpose of feeding pigs.

At the time here referred to, the reign of Edward III., the salmon fisheries of the north of England must have been pursued eagerly, as appears from the variety of contrivances for catching the fish mentioned and forbidden by the Act, Statute 6 of the 25th reign of that Prince, where we find specified gorces, mills, wears, stanks, stakes, trunks, and kiddles; and such of them as were "levied and set up" in the time of King Edward, the King's grandfather, are commanded to be let down. But it appears to have been so ordered on great rivers only; for the reason assigned for the passing of this law is, that these obstacles prevented the passage of boats. The weirs here referred to were mentioned as the new weirs; but this law was found to have so little effect, that another was passed to enforce it in the 45th year of the same king, Edward III., A.D. 1371.

It appears that at this early date Salmon were brought from Scotland into England; and they are termed Salmon of Berwick in an Act of the 31st Edward III., 1357, probably from the place of sale, as well as for another reason, presently to be stated; and this sale is regulated by the provisions of this law. As the conveyance of fresh fish from this then distant place, must have been impossible in the condition of the roads at that time, when all traffic was carried on horseback we are left to the conclusion that smoked or pickled salmon were at that time the principal object of trade with England. That the latter chiefly were meant, appears indeed from an Act of Edward IV., in his 22nd year, (A.D. 1482) in which the fishery of the Tweed is let on farm to the merchants and freemen of Berwick, with a monopoly of the salmon; and by two other Acts, of Edward IV. and Henry VII., the packing of Salmon in barrels is particularly regulated. The protection of this monopoly is continued by an Act of Henry VIII.

Popular rumour would represent this fish to have been less regarded than these regulations, and the very existence of a monopoly show it to have been; and when Dr. Fuller, who wrote so long since as the time of the first Charles, makes mention of a report, so often quoted, that in Scotland servants "*indent* with their masters not to be fed on salmon above thrice a week," he only mentions a saying which himself appears to regard as no other than a joke. (*Worthies of England, Herefordshire.*) And yet there was truth in this otherwise unlikely report. In *Notes and Queries* for May, 1857, is a quotation from Counsel's *History of Gloucester*, speaking of the House of Lepers in that city, where he says "it was a standing condition of apprenticeship, that the apprentice should not be obliged to eat salmon more than thrice a week, the object being to render him less liable to the leprosy." In a work also on the *Agriculture of Berwick*, by Robert Kerr, it is remarked that "formerly" servants stipulated with their masters that they should not be compelled to make frequent meals of salmon.

At the present time there does not appear to be any law which regulates the size of the fish which are permitted to be caught; unless we are to understand as such the dimensions of the meshes of the nets employed, which we are informed is three inches from knot to knot. But the fence times are more diversified than in ancient times, perhaps with less reason than is believed, but in compliance with the opinion of many fishermen, that the salmon of different rivers are in season at different times of the year, and that too when their geographical situation is not very distant from each other. It is allowed, however, on all hands, that the regular and natural time of spawning is from early in December to the middle of January; and that within a month after this, the spent female salmon have again gone down to the sea; and beyond affording them protection in those actions, we can scarcely discern what legislation can do for them, beyond what the removal of obstructions between Saturday and Monday can effect.

The present fence days, as generally known, are the following. The River Fowey, from the 15th December, to the 1st of May both inclusive.

The Camel . . .	December 23rd . . .	May 15th.
The Tamar . . .	November 1st . . .	April 27th.
The Dart . . .	November 15th . . .	February 15th.
The Axe . . .	November 15th . . .	April 15th.
The Severn . . .	August 1st	October 31st.
The Dee and Don .	September 20	December 12th.
Rivers of the county of Brecon, including a part of the Usk . . .	October 1st	February 27th.
The Usk, in Monmouthshire, . . .	December 1st	February 27th.

RIVERS OF SCOTLAND.

The Tay	from	August 26th	to	December 10th.
The Spey and Findhorn		August 20th		November 30th.
The Tweed . . .		August 26th		October 10th.
The Annon . . .		September 25th . . .		March 10th.
Rivers of the county of Ross . . .		August 26th		November 30th.

IN IRELAND.

The Shannon	from	August 12th	to	February 1st.

In the year 1839 notice was given of an intention by the Proprietors of the Tamar Manure Navigation, to apply to the Quarter Sessions to fix certain days, not exceeding 150, to be fence days for the Rivers Tamar, Inney, and Ettery, or Werrington, and to appoint conservators for the preservation of the salmon, and fish of salmon kind; but no certain days were named in the notice, and I have no knowledge of the event of the application.

The supply of salmon in the Rivers of Cornwall is liable to much fluctuation in different years, but there is no doubt they are far less abundant now than formerly; and will become gradually less, as the mines of copper are more extended in the east of the county, in which direction the streams frequented by this fish chiefly lie; and so it was at so distant a date as the reign of Queen Elizabeth, as we learn from Carew. The whole of this family of fishes are very sensible of the qualities of the water in which they swim; and that which is thrown out of mines of copper is not only offensive, but poisonous to them. We may therefore expect that all the species will gradually forsake us, and that a Cornish salmon will be as great a rarity as that of the Thames is said to be.

At a very early date in our Natural History there existed particular and exclusive rights of taking fish; and that, too, without a visible connection in all cases, with the ownership of the land that lay on the borders of the stream. The first Statute of the fourth of Edward I., called *Extenta manerii*, mentions mills and fishings, several and common, as things well known. The rivers of Cornwall in which I have been able to discover that such exclusive right of fishing existed, are the Tamar, the Looe, Fowey, and Camel, and the true original of those claims may be the better guessed at when we call to mind that on all the rivers thus appropriated, there existed either a royal castle, or some ecclesiastical building of a high order, for the benefit of which the royal prerogative was irresistibly put forth, or the claim submitted to as an act of merit. None of those rights are mentioned in the Domesday register; but we are not permitted from this omission to conclude that they did not exist when that survey was taken; and the kings of Scotland had from the remotest times exercised this exclusive right on the rivers of that kingdom, although they cannot be supposed to have derived it from the feudal system introduced into this country by the Norman William.

The Fowey River runs close by the walls of the ancient castle of Restormel, of which Richard, Duke of Cornwall and elected King of the Romans, was the last princely inhabitant, and which had never since been visited by a royal personage, until Queen Victoria was pleased to make a short pilgrimage to its ruins. The Stannary Court appears to have been held by Richard's authority, in the neighbouring town of Lostwithiel; and the seal of this borough, about the time of Henry IV., shews the castle and the fish, indicating the feudal rights of the earldom. The inscription on the seal is, S. oficii de manor de Lostiel. *(Moule's Heraldry of Fish.)* Carew speaks of fishings among things which the early Earls of Cornwall laid hold of, and perhaps taxed or extorted harshly and unjustly; and it is easy to suppose that the privilege of taking salmon was one of these.

I am given to understand that the fishermen of Fowey and Polruan now pay a fine or rent to the owner of Boconnoc, for the privilege of catching salmon in the harbour of Fowey; and I believe that the family of Rashleigh possess, or claim a right of a similar kind.

One of these fishermen informed me, that in the year 1843 there were in use six seans and fourteen mesh nets, for taking salmon. In one net, in that year, this man caught 300 salmon, which he regarded as making a favourable season; but he had reason to know that many more fish passed up the river after the usual closing of the fishery. In the previous year, (1842) there was also an abundant season, twenty having been caught at a single haul of the net, and forty in a day. For several years before this, the fish had been scarce.

The right of fishing in this river affords an incident in the life of Sir Richard Grenwill or Greenvil, who was by far the most infamous of those who fought in the service of King Charles I. As the Prince passed through Bodmin, says Clarendon, he received petitions from the wives of many substantial and honest men; among the rest, of the Mayor of Lostwithiel, who was very eminently well affected and useful to the King's service; all whom Greenvil had committed to the common gaol, for presuming to fish in that river; the royalty of which, he pretended, belonged to him by virtue of the sequestration granted him by the king, of the Lord Robert's estate at Lanhetherick; whereas they who were committed, pretended a title, and had always used the liberty of fishing in those waters, as tenants to the Prince of his Highness's manor of Lostwithiel, there having been long suits between the Lord Roberts and the tenants of that manor, for that royalty. Carew says: Master Glyn of Glynfoord manifesteth by this compounded name the antiquitie of his descent, and the ordinary passage there over Foy river. The store of sammons which it affordeth caused his ancestors to take the sammon speares for their armes.

The other three rivers mentioned as subject to exclusive rights, possess weirs, which must have existed before the reign of Richard the 2nd, by the act of the 17th year of which king it was rendered unlawful, and a public nuisance, to make a new weir or to straighten the entrance of an old one.

On the river Camel, a privileged right of fishery is said to be possessed, jointly by the families of Molesworth and Vivian; but there is, or was a weir at Boscarn near Dunmere, which belongs to the ancient family of Flamank. In the early part of the present (19th) century, the head weir of this weir, which was substantially built across the stream, so as to hinder the passage of every fish, was a source of great vexation to people living on the borders of the river above. It was therefore thrown down more than once by night, and a troop of cavalry was for a considerable time stationed at Bodmin, to prevent the injury. This however was not accomplished, and I believe, that at present, this hindrance to the passage of salmon does not exist.

The river Looe divides into two branches so near the harbour, and the history of these separate branches is so different, that they may be regarded as two distinct rivers. On the western branch there is a weir, which is owned by the ancient family of Trelawny, whose estate also borders on the river; but the right of fishing, as a royalty, is believed to extend considerably below the merely manorial rights of the estate, having been conveyed directly from the Crown, with the estate itself, in the reign of Queen Elizabeth. This, however, appears to have been in the possession of the Crown, only in right of a forfeiture, and by no means implies that it did not originally spring from the Dukedom. It appears, from pleadings produced at a trial held at Launceston, between the Attorney-General, *ex officio*, and Mr. Arundle, on account of the then newly erected mills and millpool near West Looe, about the end of the reign of James I., or the beginning of Charles I., that the owner of these mills was also possessed of the free fishery of Looe, which he held from Edmund, Earl of Cornwall, under the rent of thirteen shillings and fourpence. This mill is at this time held by the family of Trelawny, or their under-tenants, but it remains uncertain whether any right of fishing was conveyed with the millpool. In the weir at Shallowpool, on the western branch of the Looe, no salmon has been taken within the memory of any one now living, and the poisoning of the water by the mine at Har'ood's foot will prevent the return of prosperity to this fishery, except for a stray salmon-peal or two.

There appear to be conflicting claims on the subject of the right of fishing on the eastern branch of the Looe, and on the stream below, but on what pretence scarcely appears. In an original document which I have consulted, I find that a several fishery on the Looe river was possessed by the proprietor of the estate called Treworgy, in the twentieth year of Edward III.; and in the late Mr. John Allen's *History of the Borough of Liskeard*, we find that on the death of Edmund, Earl of Cornwall, an Inquisition was held (A.D. 1301,) into his lands, &c., when it was found, among other things, that he possessed a certain fishery in the water of Looe. In the year 1467, in the reign of Edward IV., there is paid by the borough of Liskeard to T. Kendall, Esq., 13s. 4d., for the water and fishery of Lowe. This payment is mentioned again in 1616; and in 1620 the family of Kendall, living at Treworgy, in Duloe, laid claim to the fishery of Looe river, as belonging to that estate. Treworgy, says Carew, is owned by Mr. Kendall, and endowed with a pleasant and profitable fishing and command of the river which flitteth under his house. The prosperity of the mines near Liskeard will render this fishery also of little value.

Not long after this, the property in Duloe was in possession of the family of Arundel; and this gentleman having built and enclosed the millpond in the river, already referred to, an action of encroachment was brought against him by the Attorney-General, but having advanced a claim to a right of fishery in the river, it was not denied. But the most valuable of our river fisheries is on the Tamar. When the weir at Calstock and the right of the river below it, was a portion of the grant made to the Black Prince, in the charter which constituted him the first Duke of Cornwall, the value of this must have been considerable; and in a M.S. journal in my possession, of the date 1731, and written by a gentleman who was a close observer of natural occurrences, I find, among other entries, the note "Mr. Edgcumb pays £11 per annum for the ware at Calstock, to the Prince." In the year 1832, a dealer in fish informed me that the rent of this weir, at that date, was £370. How far towards the sea this exclusive right of fishery extends, does not appear; but the borough of Saltash also possesses a grant from the Black Prince, as Duke of Cornwall, of a right of fishing in the Tamar, which at that time was valued at

8s. The right of the Duchy in the waters of the Tamar extends from the Tamar itself, to Penleigh, close under Maker, and from thence to Shiteris, or Shages Torre, now called Shag Rock, from thence to Suttonpool, and from thence to Belliston, now called Prince's Rock, in Plymouth. The fishery of the Linher, a branch of the Tamar, was held by the castle of Trematon, until Queen Elizabeth presented it to the borough of Saltash. *(Gilbert's History of Cornwall.)* .

In the M.S. journal of the gentleman above referred to, I find an entry under the date of the 15th of June, 1761, "the Saltash fishermen, with two nets, caught 85 salmon; 45 in one net, and 40 in the other; they were sold at 2d. the pound, and he adds, they may not have such another draught for the whole summer. For two of these salmon I paid 4s. 9d.; one for the servants, as being cheaper than meat. The largest salmon I have a memorandum of, weighed 30 lbs."

The fluctuation of the price of Salmon is not the least curious portion of the history of this fish; and contrary to what has happened in most instances, the ease and cheapness of carriage has not tended to lower the price in the metropolis, while it has greatly raised it in the distant parts of the empire. In the Parliamentary Report of the year 1825 it appears that a penny the pound was the price for salmon caught in the river Coquet, in the middle of the preceding century. At Kilkenny, it rose from two pence to ten pence in the course of a few years. On the river Avon it was sold at three pence towards the end of the last century; and at Totnes it was raised from 6d. to 1s. 6d., and 2s. in one man's limited experience. The opening of a railroad will undoubtedly produce a similar increase of price in Cornwall.

But there are greater contrasts in regard to price than what is here specified. Thus, in Scotland, we are told at the time when servants objected to be fed too often on salmon the stone of 19 lbs. was sold for 2s. (we presume, Scots money); and, in the petition already referred to, (Edward III.,) it is alleged, that if it be complied with, people going to London will be able to buy as good salmon for 2s. as they could get for 10s. It is probable that the highest price ever given was in February, 1809, by a Mr. Phillips, who purchased a salmon of 19 lbs. at a guinea a pound.

HUCK SALMON.

Huck or Hucho is the German name of a fish of the salmon kind, which is said to be well known in the river Danube, but has not hitherto been recognised as a British fish by any writer, except the late Dr. Fleming, whose short account of it, however, in his *Natural History of British Animals*, agrees in its important particulars with what we find in the writers of the continent of Europe whom I have been able to consult. It is mentioned in a cursory way by the old naturalist, Gesner, who, although living in Germany, appears never to have examined an example, and who, therefore, acknowledges his obligation for his imperfect figure and description to a correspondent. Ruysch also, who collected his materials from every source, is a mere copyist, for what he knew of this fish; which, he says, was kept in ponds or tanks, chiefly, it appears, that it might be always ready to form a dish at table. Ray may be taken as the representative of his friend, Willoughby, in whose person he may be supposed to speak when, in his *Synopsis*, he says, "We have seen it at Vienna. In size it differs from the common trout in being larger; for the example from which our description was taken measured 26 inches in length. Its shape also is more lengthened and slender, and the spots on its body are dark, and not red. Gesner, says he, represents all the fins, except the pectoral and tail, as dusky and spotted; the spots being either dark or golden. But (what is principally to be taken as the distinguishing character of this fish) it has no teeth along the middle of the palate, therein forming an exception to the generic definition of the genus. Artedi assigns as its character that it is of lengthened form, with (only) two rows of teeth in the palate, and having spots of no other colour, but dark. This last particular, however, must not be much depended on, since in every species it is liable to some variation. From the evidence of several witnesses we conclude that the spots are reversed: but Ruysch says they are (sometimes) golden, and mostly so about the gill, covers, and eyes, with a few bluish spots on the sides; the snout with a slight tint of pink. Dr. Fleming's account is: S. Hucho; bull trout, upper jaw longest, no teeth in the vomer; anal fin with about ten rays. In the sea and rivers. This species is little inferior to the salmon in size; its shape is more lengthened; the colour nearly the same; the flesh white and insipid. In the upper jaw there is a single row of teeth on the maxillaries, intermaxillaries, and palatines, but none in the middle on the vomer. A single row of teeth on the lower jaw; the tongue with a row of teeth on each side; the rays of the fins of one which I examined were B. 11, D. 13, P. 14, V. 10, A. 10.

Block gives a figure of this fish, which is of a dusky colour, except a slight tinge of pink about the jaws; and it is thickly covered with small dark spots, which also are sprinkled on the tail, and all the fins besides the pectoral, but his representation of the head is too large for the body.

In the winter of 1852-3, an example of this species fell under my notice from the Fowey river; its length two feet four and a quarter inches; girth, one foot one and a quarter inch; from the snout to the border of the gill covers (all measured in a straight line), five inches. Teeth in the upper jaw and mystache strong, scattered, incurved; a row round the palate, incurved towards the palate; none in the vomer. Shape of the body little compressed, being nearly round. Colour dull, with a tendency to blue, and slightly pink along the sides. Rather numerous blackish spots, with radii in three or four rays, and no light border round them. Fin rays, dorsal 15, the first very short, the fourth the longest. P. 15, V. 10, with a separate wing, half as long as the fin. C. 18, fan-shaped, obscurely counted, from the longest above and below, which are very short; five short rays before them. The aspect of this fish, and the markings of its head, differ from those of the salmon. The specimen which was, I believe, a female, is preserved by Mr. William Laughren, of Polperro.

A drawing of this fish was communicated to my late friend, Mr. Yarrell, who expressed his opinion that it was an abnormal condition of the common salmon. His words are, "I have a skin of a salmon that would have been a good match for your female. This was a salmon that had been detained in a fresh water pond rather more than three years, and he had in that time become in form more like an eel than a salmon. I have also in my drawer a specimen of salmo trutta, almost as much elongated, but I had no opportunity of ascertaining any cause for this change; but, probably, as in the case of your fish destined to live in a river, the water of which did not suit it."

I must do this excellent naturalist the justice to say that he was not furnished with any particulars beyond the drawing to enable him to form the judgment in which, I feel assured, he was mistaken. I have known another kind of fish, when in a state of unnatural confinement, to shrink into a very slender shape; but, in the present instance, this salmon was taken at its first entrance into the harbour from the open ocean, and appeared in perfect health. None others taken in the same season were like it; and, above all the rest, it cannot be supposed that any circumstances existed which could cause so great an alteration in the armature of the mouth, or the anatomical markings of the bones of the face, such as showed themselves when the parts had become dry. I possess a memorandum, earlier in date, but less particular, of another specimen of what appears to have been the same species taken in the river Looe. It was particularly noted as having no teeth in the vomer, and that the usual parasitic animals of the fresh salmon were not found on it.

THE SEA OR SALMON TROUT.

I have the evidence of Mr. Yarrell, that the species he has described, and figured under the name of the bull trout, with the trivial name of *S. Eriox*, is the same with that which is caught in Cornish rivers, and which I here call by the name of Sea or Salmon Trout. It is less abundant than the salmon and peal, and does not enter all our rivers, but I have known it taken in the Fowey and Looe; and it appears to enter the deeper streams at the same season, with the same intention as the salmon; but its habits, so far as they differ from those of the other immigrants of this family, are not well known. It has been caught in the Looe, in July, and in the Fowey, in December.

Dr. Borlase, in his *History of Cornwall*, has a reference to two species of this family, without describing them, or giving any reference to an author, by recourse to whom we might be certain of what he meant. His words are, "In the river Fowy is taken the black trout, in the month of March, till the end of June, sometimes near three feet long; and about the end of August succeeds a trout, called, from the time of its appearing, the Bartholomew trout, not so large as the black trout, being rarely more than eighteen inches.

I have little doubt that this black fish of Borlase is the huch, and that it is the same of which I have been informed of an example that was taken near Lostwithiel, which weighed 14 lbs. Of the other, or Bartholomew trout, it is highly probable that it is the sea or salmon trout.

Carew mentions this fish, under the simple name of trowte, and his verses are worthy of being repeated, for the sake of some traditional information they furnish us with. They will be found at the end of our account of the salmon peal.

SALMON PEAL.

The Peal, as it is most frequently called, has much the same habits as the salmon, and yet there is so much contrariety between them, that it has been observed, where one abounds the other becomes scarce; so that if from any cause the salmon is led to forsake a river, except, indeed, from the presence of minerals in the water, the peal presently resorts to it in increasing numbers.

This fish is expected to enter rivers early in June, and the fishery lasts a little more than two months; the method of taking them generally with the sean.

The resort of fishes of the salmon tribe, when in the sea, is little known; but the peal is not unfrequently caught in the mackerel drift nets in the spring; and, consequently, it then swims not much below the surface of the water, at various distances from land, even to the middle of the British Channel; and it has been supposed to be at this time on its advance to the coast, for the purpose of passing into the river. An example, thus taken in company with mackerel, had its stomach filled with minute fishes, on which the latter also had been gorging themselves. It is also not unfrequently taken with a line, when at sea, which the sea trout never is, so far as I have been able to learn, and the salmon rarely. The peal is in its best condition at the time of its summer immigration, but it is scarcely looked for in winter; which is the time when, for the most part, they again enter the rivers for the purpose of spawning. I have known them, indeed, with roe of the largest size early in July, and more frequently in September; but these are only such a variation of season as all fishes are liable to. And I had long felt surprise at the fact, that out of a large number of these fishes, obtained for the purpose of examination, no males could be found; and this circumstance of the scarcity, or more properly the entire absence of males, was confirmed to me by the report of an experienced fisherman, whose business led him particularly to the taking of this fish. The late L. W. Dillwyn, Esq., makes a remark of a similar kind, and as his work, entitled *Materials for a Fauna and Flora of Swansea*, was printed only for private circulation, I will here quote his remarks in full:

"*Salmo Cambricus of Donovan.*—Sewin. Common in the Tawe, as well as other rivers in the neighbourhood, and the admirers of this excellent fish have been surprised by finding that it is now considered to be the bull trout, which Mr. Jenyns has described with 'flesh inferior to that of the salmon, and cutting yellow.' Sir Joseph Banks told me, till he tasted it fresh from a river of Carmarthenshire, that he had no idea of its delicate flavour, and that he thought it too fat to bear a long journey, and that the species was wholly unknown in the London markets. Notwithstanding the great disparity in the flesh, Mr. Talbot has found in his streams at Margam, that the bull trout are always male, and the Sewen female, from which he has concluded that there is no more than a sexual difference between them. Jones, in his *History of Breconshire*, says that Sewin are numerous in all the Welsh rivers which flow to the southward, and that they are not seen in any others."

An observation, very similar to that here made regarding the males of this fish, occurred to myself so long ago as the year 1830, from the following circumstances: it was on the 22d of January when a considerable number of peal were discovered, as they were engaged in stirring up the ground in a gravelly pool, with the evident purpose of shedding their spawn. A net was procured, and the whole or greater part of them were caught; when the roe was found running from some of them, and ready to be shed in all. I myself examined ten of them, and the remainder, amounting to 20 in all, were examined by others; they varied something in colour from their ordinary appearance in summer, being something darker, and a few almost bronzed at the sides, but all were females, and only one male was found in the whole number, which, however, had its tail excoriated like those of the females, as having been engaged in the same work of stirring the gravel for the reception of the spawn. This male fish, which from its associations I cannot but conclude to be the true male of the peal, was yet sufficiently different to require a distinct description. This fish, which the fisherman called a bull trout, had its under jaw hooked as in the male salmon, the head more clumsy than in the peal; the spots large, round, not cruciform, reddish. A remarkable difference is in the adipose fin, which in the (female) peal is less, and not so far back. In this male it reaches to near the base of the tail.

It is worthy our notice that Sir Humphry Davy, in his *Salmonia*, records something not unlike this of the sea trout, but in the reverse direction. In the month of October he obtained a considerable number of these fishes, and all of them were males. How little do we know of the more particular habits of the finny races!

Four salmon peal, taken in the river Looe, were placed in a newly-made pond, and when taken out, after thirteen months, were found neither to have grown larger, nor to have altered in any particular. The Seaton river, in the east of the county, was formerly distinguished for the abundance of this fish; but the water from newly-opened mines in the neighbourhood of Liskeard, has driven them away.

There is a fish, well known in some of our streams by the name of the White Trout, which there is reason to consider as the early growth of the peal. It is found about six inches long, and has a more brilliant appearance of whiteness than the common trout, in company with which it is often taken, early in the spring. It sometimes is caught as early as January, but it usually leaves the river in April, and may, perhaps, return again as a portion of the company which, as peal, are taken later in the summer, for all the species of the salmon family are, at some period of their existence, of quick growth. That these white trouts do not come into fresh water with the intention of spawning, appears from the fact that in one instance only, I have found any roe distinguishable; and in that one, where the fish was rather larger than usual, no more than a few grains were of enlarged size. From an examination of examples of this fish, sent to him in Scotland, Sir William Jardine, who had particularly studied the characters of the salmon tribe, was of opinion that the Cornish white trout is not the *Salmo albus* of Scottish rivers, but the peal in its growth of the first year. Nor is it a contradiction to this opinion, that a large company of peal have been found in the act of spawning, so short a time before the white trout of several inches in length are found in our streams. The peal is often found with its roe enlarged for spawning, in September; and it may be that it is at the end of its first year's growth, that the white trout comes into the river.

The following piece of characteristic Natural History is taken from *Carew's Survey of Cornwall.*

What time, enricht by Phœbus rayes,
The alder his new wealth displayes,
Of budded groates, and welcome payes
Unto the spring.

The trowts, of middle growth begin,
And eygall peizd, twixt either finne,
At wonted hoste Dan Lyners Inn
Take their lodging.
Next, as the days up early rise,
In com's the peall, whose smaller size,
In his more store, and oft supplies,
A praise doth find.
Lastly the sammon, king of fish,
Fills with good cheare the Christmas dish,
Teaching that season must relish
Each in its kind.

A few words of explanation are required for this old ditty; and in one particular they are supplied by Carew himself. He remarks that the (sea) trout comes into the river at the time when the leaf of the alder is grown to the breadth of a groat; and he particularly refers to the Lynher river, a branch of the Tamar, because it runs near his own dwelling, at Anthony. The eygall peize twixt either finne, seems a quaint expression to describe the middle position of the dorsal fin of this fish, between the head and tail.

THE COMMON TROUT, OR SHOTT.

In the rivers of Cornwall and Devon, which, near their source, are usually rapid, along a rough and shelving bed, the trout is said for the most part to be of small size, as compared with such as are met with in the east and north of England. But it may be doubted whether they are so from other than casual circumstances; and there are reports of trouts which have been caught in Cornish streams, that may stand comparison with what can be advanced on good authority elsewhere. For, as regards the enormous size of 20, or even fifty pounds, ascribed to this fish in other waters, the proof is admitted by naturalists, that they are of a different species; the *Salmo ferox* of Yarrell, *British Fishes*, vol. 2, 2nd edition. Block, whose authority is good for a large part of the continent of Europe, says that the usual length of the trout is about a foot, with the weight of half a pound; and one that was caught of eight pounds, was thought to be of such extraordinary size, as to be a fit present for the Elector of Saxony. I have myself seen the drawing of a trout taken near Launceston, which measured 22 inches in length, but its weight did not exceed two pounds. An individual was caught in the river Looe, which measured 19 inches. Of seven dozen trouts taken near Rowtor, there was one which weighed two pounds and very nearly three ounces; but the largest I have any information of, was taken in the Bude Canal, and measured almost 23 inches in length, and weighed five pounds and a half. Sir Humphry Davy, in his *Salmonia*, quoting Lord de Dunstanville's edition of *Carew's Survey of Cornwall*, says that Mr. Tonkin, of Polgaron, put some small river trout, two and a half inches in length, into a newly-made pond. He took some of those out the second year, and they were about 12 inches in length; in the third year he took one out that was 16 inches; and in the fourth year one of 25 inches.

Davey says that fresh water trout are sometimes carried by floods to the sea, and come back larger, as well as altered in colour and form; and then they have been mistaken for a separate species. But it is certain that they pass into salt water without being hurried thither by floods. This I have repeatedly noticed them to do in the spring; and by this change of residence some of them acquire such a change of colour and appearance as to have led to the supposition of being a distinct species. Dr. Knox in his amusing book on the fish and fishing in the lone glens of Scotland, gives an account of what he terms the estuary trout, as different from the trout of the river; and the following is a description of an example, taken within reach of the tide, but which there is no good reason to believe other than the common species, a little modified by change of residence. Its length was 10 inches, teeth as in other trout, the tail square, pectoral fin very dark with a yellowish margin, anal also dark; but with the anterior border white, the dorsal fin dark without the anterior border white, ventrals dark with a white border, the adipose fin bordered with red, which I believe may be taken as one of the characteristic marks of the true trout. The general hue of the body was dark, with scarcely a spot below the lateral line. These spots had a red centre merged in a dark border, without a surrounding halo of lighter colour. It was caught in the month of June.

That some examples of the trout taken in salt water are not differently coloured or formed from those resident high up in our fresh streams, I have sufficient proof; and in such instances I venture to conclude that they had not been sufficiently long in the sea to have been much influenced by their novel circumstances; but the causes which lead to this variation of habit, almost amounting to a regular migration, in some and not in others, is among the secrets of nature.

Dr. Borlase remarks that a little before the time when he wrote his natural history of the county there existed in the river Conar, which divides the parish of Camborne from Gwinear and Gwythian, a trout of superior excellency, but it had been destroyed by the mines; and that which is found in the Loe Pool near Helston has been long celebrated for its size, beauty, and superior value. It had even attracted notice from royal dignity in very early times; for the estate of which this lake is a part, was from a remote date held by its possessor on conditions connected with the fish it contains. Mr. Yarrell, quoting Blount's book of remarkable tenures, says: "William Treville holds one Cornish acre of land in Degemue and Eglosderi by the searjenty of finding one boat and nets for fishing in Hellestone Lake, whensoever our Lord the King should come to Hellestone, and so long as he should stay there." In a paragraph of an advertisement offering for sale the Eglosderry estate in September, 1857, it is said: to this estate is attached the exclusive privilege of keeping a boat and net on the Loe lake, for the diversion of his Royal Highness the Duke of Cornwall. In some original pleadings of the Court of Chancery, of the reign of Charles II., it appears that the right of fishing in this lake was at that time let at the rent of ten pounds the year.

The Loe trout is indeed a very beautiful fish; but it is a matter of doubt, which at this time I am not able to clear up, whether it be a variety of the common river trout or a separate species. If, as I have been told, it has been known to weigh 17 pounds, I should with little hesitation conclude it to be a distinct kind; perhaps the same as that with which we shall close our list of the Cornish species of strictly fresh water trout. It is proper to add, however, that when an example of the Loe trout was submitted to the examination of Sir William Jardine, he gave his opinion that it was only a variety of the river trout. The particulars of its habits, with a close examination of its form are yet to be sought for.

It will surprise an angler of the more eastern or northern counties to be informed, that under ordinary circumstances the trout may be fished for in Cornwall, when the sport is entirely shut out with himself. I have known a considerable number of trout taken with a fly in the last week in January.

The trout is so entirely a fish of running streams, that we are not prepared to find it living and thriving in lakes, whether large or small, into which scarcely a current finds its way, nor from which any water can flow out. If, in addition to this, we find in such situations its form somewhat changed, and the markings of colour which are considered in general as most decisive of character to be either absent or much altered, it can scarcely be thought a hasty conclusion, if we venture to suggest that the examples referred to, may probably be a separate species.

Such are the fish of the trout kind which exist in some insulated pieces of water on the high grounds of the county, to the north or north-west of Bodmin. These pools, as they should be called, are chiefly in the parish of Luxulyan, and have the appearance as if they had been formed by some ancient workings for tin. A few fish are found in them, besides the fine species now referred to. There are some trout, and also minnows; which latter, at least, may be believed to form the food on which the larger fish are fed. How any of them can have obtained a situation in places apparently so little fitted to their habits, we have no means of knowing, for there is little shelter such as the trout of the river delights in; and hence it is that they cannot be fished for in the usual way. The people of the neighbourhood are accustomed to employ night lines, and it is by the help of this that I have been able, by the aid of a friend, to procure an example from which to take a figure and description.

The length was fourteen inches and a half; from the front to the border of the gill covers, three inches and a quarter; the body stout, and the depth carried well back to the tail. I did not weigh this example, but they sometimes reach the weight of three pounds. Teeth in the mystache, or superior maxillary bones, of moderate size, sharp and incurved in the lower jaw; tongue armed on both sides, and round the palate; along the vomer (roof of the mouth) a row of separate teeth, on an elevated ridge, in opposite pairs, with a slight channel between the rows; tail wide in proportion to its length; dorsal fin high and free. Dorsal rays 13, the first very small; C 18, besides false rays; anal 11; ventral 9; pectoral 13. The colour, dark above; the sides pale yellow, as also the gill covers and pectorals. Round spots, the size of a shot, on the gill covers; marks thickly scattered on the body, which are dark, and formed by lines encircling the border of the scales. There were no red marks on the body; although, as the colours faded, one or two faint red spots made their appearance. Belly white; the dorsal fin spotted; adipose fin without a tint of red; no whitish or pale border in front of the first dorsal or of the anal, although an undoubted trout caught in the same pool, had all these ordinary marks of a trout. The flesh of this example much resembled that of the peal.

In many particulars, this fish so nearly resembles the lake trout, *S. ferox*, described by Mr. Yarrell in his second edition of the *Natural History of British Fishes*, that I am led to suppose it possibly a variety of that fish, modified by a more limited range of water, and perhaps a different quality and quantity of food.

THE SMELT.

Osmerus Eperlanus, Cuvier. *Salmo Eperlanus*, *Lin.*

This fish must be distinguished from another bearing the same name, and not greatly unlike it in its general appearance, but of another genus:—the Atherine, *Atherina Presbyter* of Cuvier.

This true Smelt is not known on our south coast; but is reported to me as having been taken near St. Ives, on the north coast; which circumstance is the more probable, as it was noticed by Mr. Dillwyn, at Swansea.

Fishes of the salmon kind were so little known to the ancient Greeks, that although Aristotle is supposed to have mentioned the trout, under the name of Thratta or Thrassa, (as I learn from Gesner, whose authority alone, on this subject, I am able to refer to.) Ælian was not able to find a name for what must have been this fish; of which he had received a correct description, but which he thought worthy of notice only because of the strange way of fishing for it, used by the people of Macedonia. I give his narrative at some length, as it tends to show that what has been thought only a modern, and even a merely English practice, was familiarly known in some countries in remote times. Ælian's words are:—"I have received information of the following method of catching fish in Macedonia. In the river Astræos, which passes between Beroa and Thessalonica, there are fishes which are ornamented with spots of different colours; but the names they bear are best learnt from the people of Macedonia. Their food is the flies which frequent that river; and these flies differ from any that are found elsewhere, for they are not only unlike bees and wasps, or hornets, but they unite in themselves the likeness of all these insects."

The people of that country call them hippuri, or horse flies; and as they fly near the surface of the water, they are easily discerned by the fish, which therefore glides gently to the place where the shadow of the fly falls, and in the same manner as a wolf snatches a sheep from the flock, with a gulp it seizes the fly, and plunges with it to the depths of the stream. This proceeding has been noticed and copied by the fishermen, but with some variation; for they do not employ the natural fly, which will scarcely bear such handling; they therefore imitate it by art. A small quantity of purple wool is wrapped round the hook, and a couple of wings are added from the yellow neck feathers of a cock. The rod and line are each four cubits long, and this contrivance, when skilfully cast on the stream, is found to answer well in taking the fish. *History of Animals*, B. 15, C. 1. It is probable, as Gesner remarks, that Aristotle, who was the only scientific naturalist of antiquity, and who was a native of Macedonia, where this method of fishing was practised, has left us the correct name of the fish; but the only other reference I can find—it is in a Greek writer, and that a doubtful one,—to any other fish of the salmon kind, is in the same compiler, Ælian, who, B. 9, C. 59, speaks of fishes which quit the sea to enter rivers, for the sake of spawning. His reference is to the Black Sea, and his river may be only the straits of Constantinople, but it is plain that there was no name known to him for any one of these migrating fishes, if they were of the salmon tribe. The Hucho, as a fish known in the Danube, and as a regular migrant only known there, may be one of the fishes thus obscurely referred to by Ælian.

The salmon, as we have seen, is mentioned by Pliny, but at a time when luxuries were sought for at any cost, from the remotest regions, and oysters were carried to Rome from our own shores; when, also, the Romans had for a long time been settled in Britain, where this fish had always been abundant, it is not a little surprising that this author speaks of it as only esteemed by the people of a province of Gaul. We owe a little more, and only a little, to the elegant poetry of Ausonius; but he distinguishes between the salmo and salar, which modern authors have agreed to regard as one.

The disputed origin of the name of this fish, will most probably be found in the name of the river Salmona, running into the Moselle, where this fish was found in abundance, and highly valued; and the species is fixed by the words of this author.

Nec te puniceo rutilantem viscere salmo
Transierim lata cujus vaga verbera caudæ
Gurgite de medio summas referuntur in undas.

Nor may I pass thee by, with powerful tail
Raised from the whirling deep to spring aloft,
Fish of the bright red flesh.

The Salar is sufficiently distinguished, if only by being named separately.

Purpuerisque Salar stellatus tergore guttis.
With purple spots his back is sprinkled o'er,
In starlike form.

There is little added to this by Sidonius, when he terms these fishes *rapacissimi Salares*, the very ravenous salars; but naturalists are certainly in error, although our illustrious, and generally active countryman, Ray, is of the number, (see his *Dictionarium trilingue)* when they suppose this fish to be the common trout. This last is mentioned separately, under the name of Fario.

Amborum medio Fario intercepte subævo.

It is probable that either the sea trout or peal is the salar of the poet; and we know that the name Fario is derived from a source that is neither Latin nor Greek. It is the German name of the trout to the present day; and was probably the provincial name of the fish in the country where Ausonius wrote. Truta or Trutina is the equivalent of Fario, and is still the name of this fish in those parts of Italy where it is found, and from whence at last it has travelled to us.

THE SEWEN.—*Salmo Cambricus.*—Donovan.

Since writing what has been said of the salmon peal, I have had an opportunity, through the kindness of Edmund T. Higgins, Esq., of Bristol, of examining an example of the sewen from South Wales, and also of obtaining some interesting information concerning its habits and history; and from these, compared with my own observations on the peal, I am led to differ so far from the opinion of the generality of naturalists as to suppose it highly probable that the sewen is a distinct species.

Compared with the peal, the body of the sewen is deeper, and in consequence the head appears of less size than in the former fish of the same magnitude. There is also a difference in the teeth, which however slight it may appear, seems to be a permanent mark of distinction. It is that although both those fishes possess six hooked teeth arranged on the tongue in two rows, they differ in the arrangement; those of the sewen being placed in pairs opposite each other, whereas those on the tongue of the peal are unsymmetrical; the teeth of the right side being more advanced than those on the left. The first dorsal fin also is less developed; and the colour of the fish is brilliant, with pale red spots without a halo, and others that are reddish brown. The scales are considerably smaller than in a salmon of the same weight. This fish has been found of 14 and 16 pounds in weight, a size greatly exceeding what the peal has been known to reach within the extent of my observations or enquiry. Contrary to the supposition referred to by Mr. Dillwyn, both sexes are noticed by fishermen. The colour of the flesh is a fine pink, and it is even more fat and rich than the peal itself. The full grown fish enters rivers in July; a few have been found ready for spawning in August, but the usual season is October and November. The young sewens appear in the rivers in March and April, when their weight is two or three ounces; and soon after this they all go down to the sea; their colour at this time being bright silvery without spots.

It is commonly believed that the sewen is found in all the rivers of Wales, and that it is confined to the principality; a circumstance which, if true, is the more remarkable as the Cornish river Camel, the mouth of which opens at no great distance from the Welch coast, may be supposed to offer equally favourable opportunities of ascent. Its common and probably primitive name is sewen, but it is sometimes called by the more English designation of white trout and sea trout, if indeed more than one species be not included in those names.

A Statistical Investigation into the Mortality of Miners in the District of St. Ives, and the Agricultural Population in the District of St. Buryan.

By R. Q. COUCH, M.R.C.S., Esq., &c.

In continuation of my former papers on the Mortality of the Cornish Miners, I have examined the district of St. Ives, which embraces the town and parish of St. Ives, Towednack and Zennor, forming the north-eastern boundary and seaboard of the western extremity of Cornwall. St. Ives Bay terminates on the south, in the delta of the small river of Hayle, which extends beyond Trewinnard. And as the sea at Marazion, indents into the land on the south, the neck of this peninsula by which the district is joined to the main land is not more than four and a half miles across. Thus, then, so far as the geographical position of the district is concerned, it is surrounded by an equalizing sea temperature and good refreshing air. The population is of a very mixed character. The town of St. Ives has between six and seven thousand inhabitants, the chief portions of which are engaged in maritime occupations, as sailors and fishermen. Most of the others are tradesmen, shop-keepers, and such general inhabitants as are commonly found in small towns. The town itself is situated on the north-eastern extremity of the district, on the base of a narrow neck of land, and is much exposed to the S.E., E., N.E., and N. winds, and less so to the N.W., while it is entirely sheltered from the S. and S.W. winds. The streets are very narrow, very irregular, and the houses in the lower portions of the town low and crowded together. As a large portion of the inhabitants are engaged in the fisheries of the coast, and space is valuable, the cellars are often beneath the dwelling-rooms, and hence, during the pilchard season, the smells are very offensive, and ever present. But the town is, I believe, far from being unhealthy. The men are an industrious and a hardy race; they pursue their aquatic vocations not only at home, but on the shores of Ireland, the Isle of Man, and the Scotch coasts, returning in the early autumn or late summer to our annual pilchard fishery. The country around is not a very highly agricultural one. The farms are small, exposed, unwooded, and distant from each other. In the whole of the district, there is no shelter to be found from trees or wooded lanes; from nothing in fact but the natural undulations of the ground. In passing along the northern shores, the cliffs are bold and rocky, and jet abruptly into the sea. To the north of St. Ives there is the Island, and westward Clodgy Point, Hor Point and Peneynis Point, Carmen Point, and so on to the west to Gurnard's Head. From these cliffs the hills sweep up a little inland to a moderate height, so that from the rocks of the sea-coast there is a continuous ascent till you reach the top. The highest points are attained at various, but generally short distances inland. A little to the west of St. Ives rise the Penbeagle Hills, which run in a south-easterly direction, having one slope to the N.E., the other to the S.W. To the west and a little to the north are Trevalgan and little hills which are continuous with Morra Hill, and the Zennor Hills forming the Zennor Downs. On the south side the district is bounded by the elevations of Castle-an-dinas, Trink Hills and rocky downs. The whole of the district is surrounded, therefore, by a range of hills having short undulating margins towards the circumference, but forming a swampy and rough irregular basin in the centre. Halse Town, which is a large village built of good stone houses, detached from each other, with gardens around, lies on the northern extremity of the south-western slope of the Penbeagle Hills, and are entirely unsheltered from the N.W. and S.W. winds. Towednack is in the bottom flat of the basin, and is unsheltered and desolate. On the hills to the south of the church, are the mining villages of Amal-veor, Embla, &c., where there are small farms; but the cottages are unfit, many of them, for healthy occupation. From Embla you descend the valley to Nancledrea, and within the district there are several small groups of houses, such as Chyponds, &c., occupied by miners.

The district is unwooded and much exposed to every wind, and as it lies on the northern slope of the water-shed of the country, it is wet, cold, and bleak.

The population is mixed, but the miners invariably occupy the most exposed and worst built cottages, and are the most unhealthy of the inhabitants. The population of St. Ives, is about 6506, probably more at the present time, and a large portion of these are fishermen. There are engaged in the pilchard fishery 50 first-class boats, carrying five men and a boy, and 60 second-class boats, carrying four men and a boy. Besides these, there are 290 seine boats, 30 tow boats, and 10 followers, making a total of 440 boats engaged in the pilchard fishery. But the number of seines is no guide to the number of men employed, as one crew, from the arrangement of the fishery, will man several seines in rotation; but as far as I can ascertain, the separate crews are 14, and 14 to a crew, making 196 men and boys. But the men and boys engaged in the drift nets are about 500, a hardy and intelligent race,; thus making about 696 men and boys actively engaged. Towednack has a population of 1057, chiefly agriculturists and miners, scattered about in the various villages that dot the hill sides. Towednack, in 1841, had a population of 967, which in 1851 had increased to what I have now estimated it at. But the population of Zennor has decreased: in 1841 it was 1025, but in 1851 it had decreased to 918, making a total of mixed population of 8,481.

The soil is peaty and is much employed by the miners and agricultural labourers for firing, and the right of free cutting it is a bonus given to the occupiers of some of the cottages. The cottages are of much the same description as those found in the rougher portions of Lelant already described, except perhaps that they are in worse situations and more surrounded by cesspools, broken roads and pools of undrained rain. The village of Amal-voer is like a cluster of cottages huddled together on the top of a hill with scarcely space between them for access. The bed-rooms are rarely more than one in each house, and open to the ceiling. This gives the appearance of space; but if the roof is slate, it produces great heat during a summer day. During the last summer, the heat of our hottest days in these rooms was intense, which during the night was converted into great cold, by rapid radiation, and three cases, where I had taught the women to read a thermometer, the difference between the temperature night and day amounted to 25 deg. Fahrenheit, and commonly of 10 and 17 degs. If, therefore, a miner caught cold, and it became necessary for him to give up work for a day, it became a matter of importance that he should not stay in bed during that day, for the variations of temperature generally brought on low kinds of fevers and general undermining of the health. In recording my cases of fever, I find houses plastered against the tiles and the bed-room boarded off, was most free; next, houses with thatched roofs, and then those which were plastered, and the worst were those with slate roofs unplastered. Before any decided improvement can take place in the health of the miners, another description of cottage and conveniences must be supplied them.

The whole of the central part of this district is granitic, and its southern border is a coarse granite, as are all the hills; but in no part except on the north in one spot, does the granite reach the coast and that is at Wicca Cove. The slate extends along the coast from the Towans (sand hills) of Lelant to Porthminster Point, where it is associated with Trappean Ash, and rocks, and the Grauvaeke Series which fringes the coast to beyond westward of the Gurnard's head. At and around St. Ives, does it extend the most inland; so far indeed as Hellesvean and Hellesveor, Trowan, &c. Over the hornblende and trappean rocks the soil is good and bears good crops, which suffer however from the northern winds. But throughout the granite district the fertility of the soils is not so good. But where cultivation is carried on, the fields bear fair crops of barley and oats, as at Chyponds, Embla, &c. As it regards the mines, they are chiefly situated in Lelant and on the borders of Towednack, but in the neighbourhood of

St. Ives, one of the most valuable mines of the district is situated, and the minerals chiefly run near the junction of the granite with the slate and trap rocks, and especially through the slate.

The habitations of the miners, in the midst of the district are frequently of the worst description, badly built, in exposed situations, and without any of the ordinary conveniences of life. As this district lies along the northern slope of the water shed of the district it is not to be wondered at if we find the district a very unhealthy one. If in these examinations, I had taken as a district, the mining portions of St. Ives and Lelant the rate of mortality among the mining population would be worse than it now seems to be.

ST. IVES.

1837.

The records for this year are imperfect, extending only from July to December. The number of deaths occurring during these six months is 48. Of these 6 were miners, 20 males not miners, and 22 were females.

Of the 6 miners,	50·00	per cent. died of	consumption,
	16·66	,,	pneumonia,
	16·66	,,	diarrhœa,
	16·66	,,	was scalded to death.

The oldest miner died at 76 of diarrhœa; the youngest at 25 of consumption. The average age of death is 45 years and 8 months. Of other males, not miners above 10, 10·00 died of consumption; and of females above 10, 4·50 per cent. died of the same disease. From this it appears that 66·66 per cent. of miners died of thoracic diseases.

1838.

The deaths during the year are 95, and of these 6 are miners, 37 males not miners, and 52 females.

Of the 6 miners,	66·66	per cent. died of	consumption,
	16·66	,,	were killed,
	16·66	,,	from injuries to the foot.

The oldest miner died at 67 of consumption, the youngest at 45 of consumption. The average age for the year is 54 years and 6 months. Of the males not miners, who died above 10 years of age 18·91 per cent. died of thoracic diseases; and of the females above 10, 21·37 per cent. died from the same diseases.

1839.

The number of deaths during the year is 111; of these, 11 are miners, 52 males, not miners, and 48 females.

Of the 11 miners, 63·33 per cent. died of consumption,
9·09 ,, bronchitis,
27·27 ,, were killed by accident.

The oldest miner died at 73 of consumption; the two youngest at 31, one of consumption and the other was killed. The average age of the miner for the year is 47 years 6 months.

Of the males, not miners, who died above 10, 20·83 per cent. died of consumption; and of the females above 10, 19·35 per cent. died from the same cause.

1840.

The number of deaths for the year is 184; and of these, 13 were miners, 86 males, not miners, and 85 females.

Of the 13 miners, 38·46 per cent. died of consumption,
23·07 were killed.

Of the remainder, one died of age at 78, 1 of hemiplegia, 1 of fever, 1 of cholera, and 1 of small pox.

The oldest died at the age of 78, and the youngest was killed in a shaft at 15. The average age for the year is 42 years 5 months.

Of the males, not miners, above 10, 33·33 per cent. died of consumption, and 3·33 per cent. of bronchitis; aud of the females above 10, 27·77 per cent. died of consumption, and 5·55 per cent. of bronchitis.

1841.

The deaths during the year is 141; of these 6 are miners, 64 males, not miners, and 71 females.

Of the 6 miners 66·66 per cent. died of consumption,
16.66 „ bronchitis,
16·66 „ fever.

The oldest miner died of chronic bronchitis at 66, and 4 died at 29, 3 of consumption and one of fever. The average age for the year is 39 years 8 months.

Of males, not miners, above 10,
27·58 per cent. died of consumption,
13,79 „ bronchitis,
3·44 „ asthma.

Of females, above 10,
17·30 per cent. died of consumption,
7·69 „ bronchitis.

In reviewing the mortality of the last five years, the first thing that strikes attention is the great difference observed in the number of deaths in each year. In 1837, which is but a record of six months, the number is 48; in 1838 the number is 95, which being about twice the number in the previous year, is not remarkable; but in 1839 the number rises to 111; in 1840 to 184; which in 1841 again sinks to 141. In 1837, 1838 and 1839, there seems to have been no epidemic, and no one disease, beside consumption, prevailed. In 1840, however, small-pox prevailed, and was very fatal, 28 males and 23 females dying from this cause alone. 1839 seems to have been a generally unhealthy year, the chief causes of death being dropsy and disease of the stomach.

Deaths arising from age are instructively peculiar. Among the miners there is only one recorded, in 1840, at the age of 78; and he had for many years been laid up from all active work.—The following table will show the proportions.

Deaths arising from Age.

	1837.	1838.	1839.	1840.	1841.	Average.
Miners....	„	„	„	1 at 78.	„	1 in 42.
Males, not Miners....	„	3 at 87, 74, 72.	6, oldest 94, 92, 91.	6, oldest 80	3, oldest 92	1 in 11.
Females..	1 at 92.	11, oldest at 90.	9, oldest 88.	9, oldest 92	3, oldest 90	1 in 3.

Having thus seen the proportions of death arising from age, we may next compare them with death arising from thoracic diseases, chiefly from consumption, as may be ascertained from the statements made under each year.

Table of mortality from thoracic affections, in per centages.

	1837.	1838.	1839.	1840.	1841.	Aver.
Miners	66·66	66·66	72·42	38·46	83·32	65·50
Males not miners, above ten	10·00	18·91	20·83	36·66	44·81	26·24
Females above ten..	4·50	21·37	19·35	33·32	24·99	20·79

The miners are here again in considerable excess of the general population, as it regards the mortality from chest diseases. In 1840 it was at its lowest, and in 1841 at its highest development. In 1840 one is recorded as dying of atrophy, at 63, and he is not included in the list; one of small pox, and one of cholera. This year was a very unhealthy one, and many sunk, who had long been in a delicate state of health.

Accidents are not numerous but they divide themselves into two classes; in the first of which the men fall, and these are most commonly confined to the young, of which only a few are fatal. The number meeting with accidents, and some of a very serious character, are many more than the register indicates. The second class embraces such as are injured by materials, stones, &c., falling on them, and these include all ages.

Number and ages of persons accidentally killed, during five years.

1837.		1838.		1839.		1840.		1841.
No.	Ages.	No.	Ages.	No.	Ages.	No.	Ages.	
1	37	2	59 47	3	47 31 66	3	15 22 44	None.

Among the male population not miners dying of diseases of the chest, the following are the occupations in which they were employed :—

1837.

1 Tinman, aged 21.
1 Sailor, „ 19.

1838.

1 Carpenter, aged 40.
1 Draper, „ 64.
4 { Fishermen and Sailors, } aged 27, 30, 35, and 55.

4 others died of diseased heart, 1 hydrothorax, 1 bowel complaint, 1 hernia.

1839.

1 Draper, aged 29.
1 Labourer, „ 23.
3 Sailors, „ 26, 51, 76.

2 died of age, at 91, and 75; 1 diseased stomach, 1 drowned, 1 lumbar abscess, 1 of apoplexy.

1840.

1 Carpenter, aged 60.

4 Farmers, aged 55, 69, 15, 13; the others dying of cancer of lip and face. 1 killed, aged 95; 2 of age, 1 of fever.

Merchant, „ 27.

4 dying of age, and two suddenly.

Sailor, „ 50.
Tailor, „ 62.
Tinman „ 60.

Among the most healthy are farmers and farm labourers, more dying of old age in these occupations than in any other.

1842.

The number of deaths through the year is 215, and of these 16 are miners, 101, males not miners, and 98 females.

Of the 16 miners,—

3 died of	consumption,	= 25·50		44·25
1 „	hœmoptisis,			
2 died of	chronic bronchitis	= 12·50	per cent.	
1 „	laryngitis,	= 6·25	„	
4 „	fever,			
1 „	dropsy,			
1 „	ileus,			
1 „	scarlet fever			
2 „	accident,	= 12·50	„	

The oldest miner died at 73, of fever; the youngest at 14, of scarlet fever and dropsy; and the average age for the year is 44 years 6 months.

Of the males not miners,—

20·00	per cent. died of	consumption,
2·87	„	bronchitis,
5·74	„	pneumonia,
5·74	„	hœmoptisis.

Of the females about 5·66 died of consumption.

1843.

The number of deaths during the year is 165, and of these 8 are miners, 65 males not miners, and 92 females.

Of the 8 miners, 4 died of consumption = 50·00 per cent.

1 „ hepatitis,

1 „ age,

2 were killed, = 25·00 per cent.

The oldest miner died at 80, of age; the youngest was killed at 13. The average age for the year is 50 years 3 months.

Of the males, not miners,	8·00	per cent. died of	consumption,
	4·00	„	hœmoptisis,
	4·00	„	pleurisy.
Of the females..........	15·09	„	consumption.

1844.

The number of deaths for the year is 224; of these 14 are miners, 89 males, not miners, and 121 females.

Of the 14 miners, 7 died of consumption = 50·00 per cent.
3 „ typhus fever,
2 were killed, = 14.28 per cent.
1 died of suffocation,
1 „ age.

The oldest miner died of age, at 82; the youngest at 16, of typhus fever. The average age is 45 years 8 months.

Of the males above 10, not miners,
14·81 per cent. died of consumption
7·14 „ hœmoptisis,
11·10 „ pneumonia,
3·70 „ bronchitis,
3·70 „ laryngitis,
or 40·45 per cent of the general population dying of chest diseases above 10 years of age.

Of the females, 13·46 per cent. died of consumption.
1·92 „ pneumonia.

1845.

The number of deaths during the year is 101; of these 11 are miners, 45 are males, not miners, and 45 are females.

Of the 11 miners, 6 died of consumption, or 54·54 per cent.
2 „ chronic bronchitis, or 18·18 per cent.
2 „ inflammation of the kidneys,
1 „ fever.

The oldest miner died at 65, of consumption; the youngest of fever, at 21. The average age for the year is 48 years 3 months.

Of males above 10, not miners, 5·26 per cent died of consumption.
Of the females above 10....41·66 „ consumption.

1846.

The number of deaths for the year is 133; of these 12 are miners, 50 males, not miners, and 71 females.

Of the 12 miners,—
6 died of consumption = 50·00 per cent.
1 „ bronchitis = 8·33 „
1 „ pneumonia = 8·33 „ 66·66 per cent.

of thoracic diseases,—

1 died of gastritis
1 ,, hepatitis,
2 killed, = 16·66 per cent.

The oldest miner died at 63, of consumption; the youngest was killed, at 18. The average age for the year is 43 years 9 months.

Of males, not miners, above 10,—

12·50 per cent. died of consumption.

Of the females above 10,—

30·55 per cent. died of consumption.

The number of deaths during the past five years are considerably greater than those of the last five. The greatest number in the first section occurred in 1841, when they amounted to 184; but during the present period, on two occasions the numbers exceeded this and reached 224 and 215, and on no occasion does it sink below 101. In 1842, the season was a very unhealthy one. Scarlet fever prevailed among the young, and carried off 18 males and 9 females below five years of age; and also between the ages of 5 and 10 many sunk, both among the males and females. But there seems to have been during this year a feverish tendency in all diseases. Among the males, not miners, 5 died of fever; and among the females, 9 died of the same disease—a most unusual circumstance now, for of our fever cases, but few die, while the deaths here recorded are more numerous than the cases that occur in most years; and among the lying-in women, no less than four died of *Puerperal Peritonitis.* The autumn and winter were cold, and during these periods many of the old died. Among the males, five at ages varying from 96 to 78, and among the females, 15 sunk from age varying from 93 down to 82. But the greatest number of deaths occurred in 1844, when it rose to 224, and in 1843 to 164. In the latter part of 1843 and the whole of 1844, measles and hooping cough prevailed, and were very fatal; and scarlet fever still lingered. In 1844, there died among the males below five years old, 18 from measles and 13 from hooping cough; and among the females, 23 died of measles and 19 of hooping cough; and many sunk from diarrhœa.

Debility in early childhood is still a cause for very many deaths annually. But among the miners, chest diseases still destroy more than half of those recorded. The greatest proportional number occurred in 1845, which in every other respect was an average year of sickness. In 1842, &c., the per centages were reduced by the prevailing epidemic.

In speaking of thoracic affections, all kinds of diseases attacking the lungs are included, and the analysis of these will be found in the summer of each year.

A table showing the frequency of chest affections between miners and the general population, for a period of five years.

Names.	1842.	1843.	1844.	1845.	1846.	Average.
Miners	44·25	50·00	50·00	72·72	66·66	56·72
Males not miners above 10......	34.35	16·00	40·09	5·26	12·50	21·64
Females above 10............	5·66	15·09	15·38	41·66	30·55	21·66

Among the miners here recorded, it will be observed that there is much greater uniformity in the annual returns, than there is among either the non-mining males or females; but there is an almost uniform greater amount among the miners than the others, and the average of the five years gives the general result, arising no doubt from an uniform predisposing cause or causes, while the variation in the other classes may be accounted for by climactic changes. But even with this, the number of cases of chest affections seems large.

In 1844 there seems to have been an increase in the number of deaths from thoracic affections. But during that year 50 per cent. of the miners died of *consumption*; while of the 40 per cent. of other males not miners, 14·81 per cent. died of consumption; the others sinking from pneumonia and other similar attacks.

The other classes of persons sinking from consumption are—

Butcher,	died of consumption,	1 in	3.
Carpenter,	,,	1 ,,	6.
Clerk,	,,	1 ,,	1.

Farmer,	,,	6 ,,	32.
Fishermen and Sailors,		3 ,,	36.
Shoemaker,	,,	3 ,,	7.
Smith,	,,	1 ,,	2.
Tinman,	,,	1 ,,	1.

All the other trades and professions record no death from consumption.

Turning to the other side of the question, and the aspect of longevity also points to the same thing: a larger amount of mortality among miners than among other classes, or that the proportionate duration of life is shortest among miners.

The oldest miner recorded is 82, and the next in age is 80 and 73; all the others died much younger,—none above 65.

Among the non-mining, we have two at 96, and six between 96 and 90, and very many between 90 and 80, and more between 80 and 70.

Among the females, the longevity is equally remarkable. There is one at 100, and many between that and 90. But if we take a lower standard, and fix 70, the following table will show the relative proportions of such above 10 as arrive at 70. The population is divided into three classes,—one from childhood to five years; the second from five to 10; the third from 10 to death. Of the number of persons above 10 who live to 70 and above, the subjoined table will show.

Names.	1842.	1843.	1844.	1845.	1846.	Average.
Miners.	1 in 16	1 in 8	1 in 14	0 in 11	0 in 12	1 in 10 live to 70.
Males not Miners.	9 ,, 35	9 ,, 25	9 ,, 27	10 ,, 19	8 ,, 24	1 ,, 3 ,, 70.
Females	16 ,, 53	18 ,, 53	16 ,, 52	13 ,, 26	9 ,, 36	1 ,, 3 ,, 70.

1847.

The number of deaths for the year is 131; of these, 10 are miners, 51 males, not miners, and 70 females.

Of the 10 miners, 1 died of consumption. = 10·00 per cent.

1 died of pleurisy,
1 ,, diseased heart and dropsy,
1 ,, phrenitis,
1 ,, hemiplegia,
1 ,, suddenly,
1 ,, age,
3 ,, accident.

The oldest died at 73, of age; the youngest was killed at 15. The average age for the year is 49 years 2 months.

Of the males, not miners, above 10,—

6·89 per cent. died of consumption,
3·44 ,, pneumonia.

Of females above 10,—

13·95 per cent. died of consumption.

1848.

The number of deaths for the year is 160; of these, 11 are miners, 74 males, not miners, and 75 females.

Of the 11 miners,—

7 died of consumption = 63·63 per cent.
3 ,, dysentery,
1 ,, erysipelas.

The oldest died at 72, of dysentery; the youngest at 14, of consumption. The average age for the year is 42 years 9 months.

Of the males, not miners, above 10,—

17·85 per cent. died of consumption,
3·56 ,, pneumonia.

Of the females above 10,—

10·63 per cent. died of consumption,
10·63 ,, bronchitis,
2·12 ,, pneumonia.

1849.

The number of deaths for the year is 154; of these 11 are miners, 60 males, not miners, and 83 females.

Of the 11 miners,—

3	died of	consumption, or 27·27 per cent.
1	,,	pneumonia, or 9·09 per cent.
1	,,	influenza,
1	,,	age,
1	,,	diarrhœa,
1	,,	dropsy,
2	,,	cholera,
1		was killed.

The oldest died at 84, of age; the youngest was killed, at 15. The average age for the year is 38 years 6 months.

Of the males, not miners, above 10,—

11·53 per cent. died of consumption.

Of the females above 10,—

11·11	per cent. died of	consumption,
1·89	,,	pneumonia,
7·40	,,	asthma.

1850.

The number of deaths for the year is 146; of these 11 are miners, 57 males, not miners, and 78 females.

Of the 11 miners, 5 died of consumption = 54·54 per cent.

1	,,	tracheitis,
1	,,	suddenly,
2	,,	killed.

The oldest died at 76, of consumption; the youngest at 26, also of consumption. The average age for the year is 45 years 10 months.

Of the males, not miners, above 10,—

	11·53	per cent. died of	consumption,
	11·53	,,	pneumonia,
	3·84	,,	asthma.
Females above 10,	26·00	,,	consumption,
	6·00	,,	asthma,
	4·00	,,	pneumonia.

1851.

The number of deaths for the year is 224; of these 16 are miners, 90 males not miners, and 118 females.

Of the 16 miners,—

4	died of	consumption = 25·00 per cent.
5	,,	dysentery = 31·25 per cent.
2	,,	age,
1	,,	nephritis,
1	,,	malena,
1	,,	small pox,
1	,,	fever,
1	,,	sudden.

The oldest died at 87, of age; the youngest at 16, of fever. The average age for the year is 46 years 11 months.

Of the males not miners, above 10,—

23·23 per cent. died of consumption,
3·33 ,, pneumonia.

Of the females above 10,—

14·51 per cent. died of consumption.

The greatest rate of mortality occurred in 1851, which seems to have been a generally unhealthy season. Among the adults, dysentery prevailed to a very great extent, but was most fatal among the females, 31·66 per cent. dying from this cause alone. Among the young, in addition to diarrhœa and dysentery, small pox prevailed and carried off a great number.

The next most unhealthy year was 1848, when measles, hooping cough and dysentery were epidemic, and pneumonia and fevers were more than usually common. In 1849 cholera prevailed, and many sank from it. 1847 and 1850 seem to have been characterized by prevailing health.

During the period of five years ending in 1851, diseases of the chest still prevailed, and still had its chief development among the miners; but it is the most favourable towards the miner's health of any yet examined. The number is less than usual by nearly one half on the average of five years, and in 1851 the per centage is less than in the general male population; but in consumption alone it still is above all the others. It must be remarked however, that during that year, five died of dysentery, and this considerably reduced the per centages of the other attacks.

It is somewhat remarkable that pneumonia is a somewhat rare disease among miners.

Table of thoracic diseases in miners and others.

	1847.	1848.	1849.	1850.	1851.	Average.
Miners.........	20·00	63·63	36·36	54·54	25·00	39·90
Males not miners above 10......	10·33	21·41	11·53	26·90	26·56	19·34
Females........	13·95	23·38	20·40	36·00	14·00	21·58

The occupations of the males, not miners, in which consumption occurs, and the proportions in which they obtain, are as follows:

Blacksmith	1 in 5
Carpenter........................	1 in 10
Farmer..........................	8 in 34
Fishermen and Sailors	3 in 40
Labourers........................	1 in 6
Shoemakers	4 in 9
Shipwrights......................	1 in 8
Tailors	1 in 5

Having thus seen the rate of mortality in the general population, as well as among the miners, attention may now be paid to the proportions on each division attaining the age of 70 and upwards.

	1847.	1848.	1849.	1850.	1851.	Average.
Miners.....	1 in 10	1 in 11	1 in 11	2 in 11	3 in 16	1 in 7 reaches 70.
Males not miners....	14 in 29	11 in 28	6 in 26	10 in 26	12 in 30	1 in 3 nearly.
Females ...	24 in 43	20 in 47	18 in 54	19 in 50	13 in 62	1 in 3 nearly.

The oldest men among the miners reached 87 and 84, the others ranging from 70 to 76. Among the general male population, one reached 92, and most of the others ranged about 87 to 84. Among the females five were above 90, one being 97, and others fluctuating about 92 and 94, and more were between 80 and 90. So that the advantage of longevity is much more decisive in favour of the general population than appears in the accompanying table. And, on examining the returns made from the mines, as to the number and ages of the men actually engaged, it clearly appears that not 1 per cent. of the men above 70 are actually engaged, and those who are engaged are chiefly employed in some light work at the surface. The greatest part are, however, kept as invalids at home. But, among the farmers and farm labourers, many work till 70, and a few to 80, and yield only to mere old age.

Accidents are less numerous than in St. Just; in 1851, there were none; as was also the case in 1848. In 1849 one was killed in eleven, and two in eleven occurred in 1850, aged 44 and 36. In 1847, three out of eleven were killed at the ages of 15, 28, and 28.

1852.

The number of deaths for the year is 178; of these 12 are miners, 86 males not miners, and 80 females.

Of the 12 miners,—

41·66	per cent. died of	consumption,
8·33	,,	pneumonia.
8·33	,,	diarrhœa,
8·33	,,	fever,
8·33	,,	killed,
8·33	,,	apoplexy,
16·66	,,	dysentery.

The oldest miner died of consumption, at 73; the youngest died of consumption, at 23. The average age for the year is 46 years 1 month.

Of the males not miners, above 10—

9·37	per cent. died of	consumption,
3·12	,,	pneumonia,
6·25	,,	asthma.

Of the females above 10,—

10·90	per cent. died of	consumption,
3·63	,,	pneumonia,
1·81	,,	bronchitis.

During the year, many deaths among the females occurred from diarrhœa and dysentery, while the male population had only one death from these causes. Hooping cough also prevailed, and seven deaths are recorded, four among the males, and three among the females.

1853.

There died during the year 157; of these 11 were miners, 70 males not miners, and 76 females.

Of the 11 miners,—

45·45	per cent. died of	consumption,
9·09	,,	pneumonia,
9·09	,,	asthma,
9·09	,,	diarrhœa,
18·18	,,	were killed,
9·09	,,	fungus of leg.

The oldest miner died at 67, of consumption; the youngest at 13, of fungus of leg. The average age for the year is 44 years 1 month.

Of males not miners above 10,—

24·00	per cent. died of	consumption.
4·00	,,	asthma.

Of females above 10,—

34·88	per cent. died of	consumption,
4·65	,,	pneumonia.

1854.

There died during the year 196; and of these 14 were miners, 91 males not miners, and 91 females.

Of the 14 miners,—

64·28	per cent. died of	consumption,
7·14	,,	asthma,

7·14 per cent. died of dysentery,
7·14 „ died suddenly,
14·28 „ were killed.

The oldest miner died of consumption, at 76; the youngest was killed at 20. The average age for the year is 47 years 4 months.

Of the males not miners above 10,—
18·51 per cent. died of consumption,
3·70 „ pneumonia.

Of the females above 10,—
40·00 per cent. died of consumption,
2·85 „ bronchitis,
2·85 „ pneumonia.

During this year, scarlet fever prevailed, as well as measles. Among children below 5, 17 males and 10 females died of scarlet fever, and 11 died of measles.

1855.

There died during the year 136; and of these 7 were miners, 67 males not miners, and 62 females.

Of the 7 miners,—
42·85 per cent. died of consumption,
14·28 „ diseased heart,
14·28 „ palsy,
14·28 „ suddenly,
14·28 „ from accident.

The oldest miner died at 78 suddenly; the youngest of diseased heart, at 15. The average age for the year is 43 years 10 months.

Of the males not miners above 10,—
10·00 per cent. died of consumption,
10·00 „ pneumonia.

Of the females above 10,—
23·07 per cent. died of consumption,
5·12 „ pneumonia.

The whole year was free from any prevailing epidemic.

1856.

There died during the year 120; of these 3 were miners, 59 males not miners, and 58 females.

Of the 3 miners,—

33·33	per cent. died of	consumption,
33·33	,,	diarrhœa,
33·33	,,	killed.

The oldest died at 59, of diarrhœa; the youngest was killed, at 14. The average age for the year is 41 years 8 months.

Of the males not miners above 10,—

17·85	per cent. died of	consumption,
3·57	,,	asthma.

Of the females above 10,—

30·76	per cent. died of	consumption,
2·56	,,	asthma.

This seems to have been an average year; croup prevailed, but there are not many deaths recorded under this head.

The mortality for the last five years has not been characterized by much variation. The greatest number of deaths occurred in 1854, but this arose from the prevalence of scarlet fever and measles, which were very fatal in children below 5. The next in the scale of severity is 1852, when the deaths were 178, but during the summer and autumn diarrhœa and dysentery prevailed to a very great extent, and was very fatal. And the prevalence of any epidemic will considerably modify any estimate of the proportional occurrence of any class of diseases, in any section of persons, viz., adults and children, in which they may occur. The prevalence of thoracic diseases, observed much the same periods of severity as the general increase of mortality. The greatest amount of deaths from chest affections occurred in 1854, when it amounted to 71·42 per cent. The next two years of greatest severity were 1852 and 1853, equally remarkable as being highest in general mortality. But in 1856 when the general mortality sunk to 120, death from thoracic diseases were nearly equalized in all classes.

A table of mortality from thoraric diseases.

	1852.	1853.	1854.	1855.	1856.	Average.
Miners	44·99	64·63	71·42	48·85	33·32	53·64
Males not miners above 10......	18.74	28·00	21·21	20·00	21·42	21·87
Females above 10............	16·34	39·53	45·70	28·19	33·32	32·61

A table of the average mortality from thoracic diseases during each five years, for the period embraced in this paper of 20 years.

	1837 to 1841	1842 to 1846	1847 to 1851	1852 to 1856	Average.
Miners ...	65·50	56·72	39·90	53·64	53·94
Males not miners above 10.	26·24	21·64	19·34	21·87	22·24
Females above 10	20·79	21·66	21.58	32·61	24·16

From these tables it appears that even under the lowest rate of mortality of the miners from chest affections, the number is greater than the highest rate among the other classes, and that very commonly the miners more than double their deaths over that from the general male population, or the more susceptible females. If the average of each five years be taken, this result will be too uniform to be accidental, and in the average for twenty years, the deaths from this single class of diseases among miners, is more than what occurs both among the males and females together. Now as this result, with varying degrees of intensity, is observable also in the mining districts of St. Just as well as Lelant, it must be considered as arising entirely from the nature of the occupation of the miner. The results are rather more unfavourable even than they appear to be here.

In the chest affections among the miners, the largest numbers are consumption, and from *post mortem* examinations which I have made, the consumption here indicated may be taken as meaning tubercular disease; but among thoracic diseases of the general population are great numbers of bronchitis and pneumonia—which are increased by and may depend entirely on climatric changes. Remove these from the investigation, and the disproportionately large numbers of miners sinking from consumption would present a frightful picture.

The occupations of the non mining males in which consumption, &c. occurs, and the proportions in which they obtain.

Barber	1 in 2
Butcher	
Carpenter	3 in 9
Cooper	1 in 2
Draper	1 in 2
Fisherman and sailors	7 in 56
Farmer	2 in 29
Gardener	2 in 3
Sexton	1 in 2
Shipwright.........................	1 in 3
Shoemaker.........................	2 in 6

The numbers included in this list are so small, that no conclusion can be drawn from them. The farmers, labourers, and sailors, which are the most numerous and most exposed of our general population are not so liable to chest affections as miners.

In the former estimate the sailors were 1 in 13, in this 1 in 8. Farmers were also in a former estimate as 1 in 4, in this about 1 in 14, and most of the labourers died of age.

A table showing the proportions in which the age of 70 is attained in persons above 10.

	1852.	1853.	1854.	1855.	185 6	Average.
Miners	1—13	1—11	2—14	2—7	0—3	1 in 10
Males not miners above 10......	16—32	6—25	8—27	19—40	9—28	1 in 3
Females	17—55	14—43	13—35	6—39	11—38	1 in 4

The oldest miner for the past five years was 78, and one was 76; but among the general males there were three above 90, and there were many between 90 and 80, ranging from 89 to 84 and 80. Among the females the oldest was 93, four others were at 90, so that longevity not only numerically, but in actual age is considerably in favour of the general population.

An examination into the mortality of the Agricultural population of the district of St. Buryan from June 1837 *to* 1856, *in comparison with the mortality of the Miners.—R. Q. C.*

The district of St. Buryan is purely an agricultural one, and embraces the parishes of St. Buryan, St. Levan, and Sennen. It lies contiguously to St. Just and to the south of it. On the west its irregular shores are bounded by the Atlantic. This includes the Lands-end and Tol-pedn-penwith. The southern shores are also washed by the ocean. Inland it is bounded on the north by St. Just, and on the east by Paul and Sancreed, portions of other districts already examined. The whole of the area is composed of coarse granite, except a small portion or point of rocks at the water mark called the Black Rock, inside the Bucks and the immediate eastern point from Carn Boscawen. The shores are bold and steep, the cliffs precipitous. On the northern margin of the district where it joins St. Just, are several high hills, such as Chapel Carnbrea, Bartinney, &c.; but to the south of this, there are no elevations of importance. The surface is very undulating, and the valleys generally shallow. The whole of the district consists of an elevated table land, and the valleys seem to be depressions or ravines sunk in it. The valley of Lamorna is short, deep, picturesque and sterile. The valley with the stream of St. Loy, is short and well wooded from the domain of Boskenna. The valley of Penberth is short, abrupt and picturesque leading up to the bottoms, where it is well cultivated, All the other valleys opening to the sea, are mere valley-like indentations of the shores. The general appearance of the country is that it is unwooded, but in a fair state of cultivation. The farm-houses are good and the cottages for the labourers much more habitable and surrounded with more domestic comforts than those of the miners generally. The sleeping apartments are not all that could be desired, either for number or space, but still they are much better than the cottages in the remote portions of St. Just, and greatly better than the cottages of Lelant, Towednack, &c. The men are altogether engaged in agriculture, except a few miners who reside on the borders of St. Just; but these will be carefully seperated in the following investigation. There is not a mine in the district; but there is tin in the stream running from Lamorna. A small quantity has been found in the eastern branch, but in the western it has been found abundantly throughout its whole length. The district is therefore entirely agricultural. There are but few villages in the district. The church town of St. Buryan, Penberth fishing cove, Treen, St. Levan, Sennen and Sennen Cove, near the Land's-end are the chief. The inhabitants are not huddled together, except the fishermen's huts at Sennen Cove, which are exceedingly bad. The inhabitants are not very numerous, and are much scattered. St. Buryan has 1,658 inhabitants, St. Levan 502, and Sennen 652, making altogether 2,812, composed of an agricultural and a fishing population. The trade occupations amount to nothing, for there is but little more than the innkeeper, blacksmiths, and carpenters. The population may therefore be considered in a fair position to maintain health and enjoy longevity.

ST. BURYAN.

1837.

There died during the half-year ending December, 25; of these 13 were males, and 12 females.

Of the 13 males,—

4 were engaged in agriculture,
1 was a blacksmith,
1 ,, sailor,
1 ,, miner,
1 ,, pauper,
1 ,, shoemaker,
4 were young.

Of the general male population above 10, 33·33 per cent died of diseased chest.

Of the 4 agriculturalists,—

1 died of consumption = 25·00 per cent.
1 ,, apoplexy,
1 ,, brain fever.

Of the 12 females,—

3 died of chest affections = 25·00 per cent.

The oldest male died at 81, of cancer of the lip.

The oldest female died at 88, of age.

Of all the male deaths 23·00 per cent. died below 5.

Of all the female deaths, 33·33 per cent. died below 5.

1838.

There died during the year 42; of these 18 were males, and 24 females.

Of the 18 males,—

7 were engaged in agriculture,
4 were sailors,
1 was a blacksmith,
1 ,, shoemaker,
4 were young.

Of the general male population, 23·07 per cent. died of diseased chest.

Of the 7 agriculturalists, 1 died of consumption, a day labourer, = 14·28 per cent. All the others died of age, at 80, 82, 83, 84, 84, 88.

Of the 24 females,—

0 died of consumption,
1 ,, pneumonia = 4·16 per cent.

The oldest female died of age, at 90.

Of all male deaths, 33·33 per cent. died below 5 years of age.

Of all female deaths, 37·50 per. cent. died below 5 years of age.

1839.

There died during the year 41; of these 22 were males, and 19 females.

Of the 22 males 11 were agriculturalists,

1 was a schoolmaster,
1 ,, clergyman.

All the others died young. Of all males above 10 = 15·37 per cent. died of consumption.

Of the 11 agriculturalists,—

1 died of consumption = 9·09 per cent.
2 ,, age, at 86 and 88.
2 ,, inflamed leg, at 83 and 67.
2 ,, dyspepsia, at 70 and 78.
1 ,, stoppage of bowels, at 70.
1 ,, debility, at 61.
1 ,, hydro-thorax, at 52.
1 ,, fever, at 31.

Of the 19 females,—

0 died of consumption.
8 ,, age, at 94, 83, 83, 82, 77, &c.
1 ,, dropsy, at 62.

The oldest male died at 88, a farm labourer.

The oldest woman at 94, of age.

Of all male deaths, = 36·36 per cent. died under 5.

Of all female deaths, = 31.57 per cent. died under 5.

1840.

There died during the year 43; of these 21 were males, and 22 females.

Of the 21 males, 5 were agriculturalists, all the others were below 10 years of age.

Of the 5 agriculturalists,—

1 died of consumption = 20·00 per cent.,
2 ,, age, at 84 and 74,
1 ,, debility after fever,
1 ,, enteritis.

Of the general male population above 10, 20·00 per cent. died of consumption.

Of the 22 females,—

0 died of consumption,
1 ,, pneumonia, or 4·54 per cent.

The oldest male died of age, at 84.

The oldest female died of age, at 85.

Of all male deaths = 66·66 per cent. died below 5.

Of all female deaths = 31·81 per cent. died below 5.

Scarlet fever and small pox occurred among children, but was not very fatal.

1841.

There died during the year 73; of these 37 were males, and 36 females.

Of the 37 males,—

9 were agriculturalists,
2 ,, blacksmiths,
2 ,, shoemakers,
1 was a soldier,
1 ,, fisherman.

Of the general male population 13·33 per cent. died of consumption.

Of the remaining 22, 15 died below 5 years old, 9 of debility, 2 of small pox, 1 of burn, 1 of scarlet fever, 1 of croup, 1 of pneumonia.

Of the 9 agriculturalists,—

0 died of consumption,
5 ,, age, 99, 92, 77, 75, 71,
1 ,, brain fever,
1 ,, small pox,
1 ,, fits at 28,
1 ,, stoppage of the bowels.

The oldest male, an agricultural labourer, died at 99, of age.

The oldest female died of age, at 88.

A table showing the comparative frequency of thoracic diseases between the miners of St. Just, Lelant and St. Ives, and the agriculturalists of St. Buryan.

	1837.	1838.	1839.	1840.	1841.	Average.
St. Just........	41·6	33·33	52·62	47·81	40·90	44·06
Lelant.........	77·77	49·98	71·42	67·75	73·33	68·05
St. Ives........	66·66	66·66	72·42	38·46	83·32	65·50
Agriculturalists of St. Buryan	25·00	14·28	9·09	20·00	0·00	13·67

St. Just stands in very favourable contrast with Lelant and St. Ives, but the contrast between the miners of St. Just and the agriculturalists of St. Buryan is very striking, and greatly in favour of the agriculturalist. In St. Just, the most healthy of the mining districts, the prevalence of thoracic disease of a fatal character is more than three times as much as it is in St. Buryan, though the districts lie side by side.

The trades or occupations in which thoracic diseases occur exclusively of the agricultural class with these proportions are.

Blacksmith	2 in 4
Fisherman	1 in 3
Shoemaker	2 in 4
Schoolmaster	1 in 1
Soldier	1 in 1

This freedom from chest affections among the male population is equally apparent among the females. For including the whole of the female population, the amount is considerably less than what is observed either in St. Just or Lelant.

A table showing the frequency of thoracic affections in females of a mining population, and of an agricultural district.

Females.	1837.	1838.	1839.	1840.	1841.	Average.
Mining. St. Just	....	....	....	....	....	....
Mining. Lelant	30·00	17·91	31·02	36·36	31·72	31·72
Agriculture. St. Buryan	25·00	4·16	0·00	0·00	5·55	6·94

The longevity is also very remarkable; in the half year of 1837 three died above 70, and of these two were above 80; and in 1838 out of 18 males of all ages, 7 died above 70, and so indeed among all the other years. It was seen among the mining population that more than half the deaths occurring, took place below 5 years of age, which was considerably above the average ratio. But in this agricultural parish the per centage is considerably reduced.

A table of per centages of death below 5, in Buryan.

	Males.	Females.
1837	23·00	33·33
1838	33·33	37·50
1839	36·36	31·57
1840	66·66	31·81
1841	41·66	36·11

1842.

There died during the year 54; of these, 28 were males and 26 females.

Of the 28 males,—13 were agriculturalists,
3 „ carpenters,
1 was a blacksmith,
1 „ fisherman,
1 „ shoemaker,
1 „ a sexton.

Of the remaining 8, all died below 5 years of age.

Of the 13 agriculturalists,—
0 died of consumption,
4 „ age, 82, 80, 78, 75,
2 „ suddenly, 72, 72,
1 „ stoppage of the bowels, at 75,
1 „ dropsy, at 56,
1 „ of diseased liver, 48,
1 „ enteritis,
1 „ fever,
2 „ debility, 57, 44.

Of the 26 females,—
5 died of age, 90, 87, 81, 77, 60.
2 „ consumption, = 7·69 per cent.,
3 „ dropsy, 78, 64, 26,
2 „ in childbirth,
1 „ enteritis,
1 „ fever,
1 „ brain fever,
1 „ cholera.

Of the remaining ten, all died below 5 years of age.

The oldest male died at 82, a farmer, of age.

The oldest female died at 90, of age.

Of all the male deaths, 28·57 per cent. died below 5 years of age.

Of all female deaths, 36·11 per cent. died below 5.

1843.

There died during the year 49; of these, 22 were males and 27 females.

Of the 22 males,—

6 were agriculturalists,
1 was a baker—suddenly, 32,
1 ,, fisherman, age 85,
1 ,, glazier,
1 ,, miner, of consumption.

Of the 6 agriculturalists,—

0 died of consumption,
3 ,, age, at 87, 83, 80,
1 ,, fever,
1 ,, accident,
1 ,, diabetes,

Of the 27 females,—

2 died of consumption, = 7·40 per cent.
4 ,, age, at 90, 88, 84, 76,
3 ,, fever,
2 ,, dropsy, 74, 49,
1 ,, palsy, at 80,
1 ,, enteritis,
1 ,, diarrhœa,
1 ,, in childbed.

and ten died below 5 years of age.

The oldest male died at 87 years of age.

The oldest female died at 90 years of age.

Of all male deaths, 50·00 per cent. died below 5 years of age.

Of all female deaths, 37·03 per cent. died below 5 years of age.

Scarlet fever prevailed among the males below 5, and not among the females.

1844.

There died during the year 59; of these, 32 were males, and 27 females.

Of the 32 males, 9 were agriculturalists.

Of the remaining 23,—20 died below 5 years of age; principally of hooping-cough, measles and pneumonia.

Of the 9 agriculturalists,—

2 died of consumption, = 22·22 per cent.
1 ,, age, 75,
1 ,, palsy, 77,
1 ,, dropsy, 70,
1 ,, stoppage of the bowels,
1 ,, measles,
1 ,, enteritis,
1 ,, throat cancer, 77.

Of the 27 females,—

4 died of consumption, = 14·81 per cent.
3 ,, age, 94, 77, 75,
1 ,, dropsy, 79,
1 died suddenly, 66,
1 ,, phrenitis,
1 ,, in childbed.

The oldest male died at 77 years of age.

The oldest female died at 94 years of age.

Of all male deaths, 62·50 per cent died below 5.

Of all female deaths, 51·85 per cent. died below 5.

Measles and hooping-cough prevailed.

1845.

There died during the year 38; of these 25 were males and 13 females.

Of the 25 males,—

7 were agriculturalists,
2 ,, sailors,

1 was a fisherman,
1 „ miller,
1 „ carpenter.

Of the 7 agriculturalists,—

0 died of consumption,
4 „ age, 88, 78, 78, 74,
2 „ fever,
1 „ enteritis, at 70.

Of the 13 females,—

2 died of consumption, = 15.38 per cent.
1 „ age, 78,
1 „ cancer of the breast.

The oldest male died at 88 years of age.

The oldest female died at 85, of cancer.

Of all male deaths, about 44·00 per cent. died below 5 years of age.

Of all female deaths, 23·07 per cent. died below 5.

1846.

There died during the year 42; of these 23 were males and 19 were females.

Of the 23 males,—

10 were agriculturalists,
2 „ blacksmiths,
2 „ shoemakers,
1 was a miner, of consumption.

Of the 10 agriculturalists,—

1 died of consumption = 10·00 per cent.
1 „ retention of urine, 85,
2 „ hepatitis,
1 „ hydro-thorax,
2 „ fever,
1 „ typhus,
1 „ apoplexy, 22,
1 „ unknown.

Of the 19 females,—

2 died of consumption = 10·52 per cent.
6 ,, age, 95, 93, 84, 80, 80, 76.
1 ,, palsy, 71.

The oldest male died of fever, at 87.

The oldest female died of age, at 95.

Of all male deaths, 34·78 per cent. died below 5.

Of all female deaths, 31·54 per cent. died below 5.

The freedom from diseases of the chest among agriculturalists is again very apparent when compared with the mining districts, or with the trades having indoor occupation.

A table of comparative frequency of chest affections in miners and agriculturalists.

Males.	1842.	1843.	1844.	1845.	1846.	Average.
Miners, St. Just......	47·81	35·29	59·25	71·35	55·55	53·85
Miners, Lelant.	50·00	57·14	75·00	57·14	56·12	59·08
Miners, St. Ives......	44·25	50·00	50·00	72·72	66·66	56·72
Agriculturalists, St. Buryan....	0·00	0·00	22·22	0·00	10·00	6·44

In 1837, as well as in 1843, the death of a miner is recorded in the parish of Sennen, forming a portion of the district of St. Leven, and one of these died of consumption and the other of fits. The average of small numbers is very likely to be erroneous, by being excessive, as every case is forced into undue importance, but yet in these two cases of miners, the general conclusion of prevalence of consumptive disease in the class to which they belong is indicated. So here among the agriculturalists, the low per centage of chest diseases, might have in the first five years been accidental, yet this accidental character is partially destroyed by the same result being observed in this the second series of years. Among the female population also, the agricultural districts are much more favourable to health than in the mining. Now as the females in each case are similarly occupied about domestic affairs at home, or in the one case, by occasionally working in the fields during the spring and summer, or in the other, by working at the mines at the surface under sheds, there must be something in transmitted influences from parents to children to account for the diversity in regard to health. The daughters of miners, who have married agriculturalists, are more liable to chest colds than others, and most of them die off in consumptious or bronchial attacks before attaining any great age. This will be seen by the following table.

A table of comparative mortality from chest affections in females of mining and agricultural districts.

Females.	1842.	1843.	1844.	1845.	1846.	Average.
Mining. St. Just......	21·73	16·35	16·06	27·58	29·54	22·55
Mining. Lelant.......	18·75	22·33	45·71	38·84	32·50	31·22
Mining. St. Ives......	5·66	15·09	15·38	41·66	30·55	21·66
Agricultural. St. Buryan. ..	7·69	7·40	14·81	15·38	10·52	11·16

From this table it appears that the average amount of mortality among the female mining population is nearly twice as great as that observed among the agriculturalists.

The rate of mortality among children below 5 years of age is also considerably less than what obtains among the miners, as may be seen by the following table, and it is in a less ratio also than the general one of the kingdom

Rate of mortality below 5 years of age in St. Buryan.

	Males.	Females.
1842	28·57 per cent.	36·11 per cent.
1843	50·00 ,, ...	37·03 ,,
1844	62·50 ,, ...	51·85 ,,
1845	44·00 ,, ...	23·07 ,,
1846	34·78 ,, ...	31·54 ,,

1 died of palsy, at 79,
1 ,, dropsy, at 78,
1 ,, suicide,
1 ,, fever.

Of the 22 females,—

1 died of consumption = 4·54 per cent.
8 died of age, from 93 downwards.

The oldest man, a farm labourer, died at 81, of age.

The oldest woman died of age, at 93.

Of all male deaths, 23·07 per cent. died below 5 years of age.

Of all female deaths, 45·45 per cent. died below 5.

1850.

There died during the year 38; and of these 22 were males and 16 females.

Of the 22 males, 9 were agriculturalists.

Of the remaining 13, all were below 5 years of age.

Of the 9 agriculturalists,—

1 died of consumption = 11·11 per cent.
3 ,, age, at 84, 78, 74,
2 ,, cancer of stomach, at 64, 51,
1 ,, debility, at 51,
1 ,, dropsy,
1 ,, fever.

Of the remaining 13, all were below 5.

Of the 16 females,—

0 died of consumption,
2 ,, age = 12·50 per cent.

The oldest man was a farmer, and died at 84,

The oldest woman died of age, at 86.

Of all male deaths, 59·09 per cent. died below 5 years of age.

Of all female deaths 37·50 per cent. died below 5.

1851.

There died during the year 43; of these 18 were males and 25 were females.

Of the 18 males,—

4 were agriculturalists,
1 was a mason,
1 „ coastguard.

Of the 4 agriculturalists,—

1 died of consumption = 25·00 per cent.
1 „ retention of urine,
1 „ debility,
1 „ dropsy.

Of the 25 females,—

3 died of consumption = 12·00 per cent.
6 „ age = 24·00 per cent.

The oldest male, a mason, died at 84, of age.

The oldest female died at 88, of age.

Of all male deaths, 61·11 per cent. died below 5 years of age.

Of all female deaths, 16·00 per cent. died below 5.

The result of the examination of the past 5 years gives the same relative advantage of an agricultural population over that of the mining, as it regards consumption, as the previous ten years had done. And this is still further confirmed by the greater numbers of agriculturalists who live to 70, in addition to the many who attain extreme old age. The advantages of the agricultural population in reference to thoracic diseases may be seen by the subjoined table.

A table of the comparative frequency of thoracic diseases in the mining and agricultural districts.

Males.	1847.	1848.	1849.	1850.	1851.	Average.
Miners. St. Just......	63·32	57·13	70·35	53·10	62·50	61·28
Miners. Lelant.......	61·89	69·23	64·70	57·13	47·61	60·11
Miners. St. Ives......	20·00	63·63	36·36	54·54	25·00	39·90
Agricultural. St. Buryan. ..	14·28	33·33	0·00	11·11	25·00	16·74

The lowest rate of mortality among miners is more than twice as much as occurs among the agriculturalists.

A table showing the rate of mortality among the females of the mining and agricultural districts.

Females.	1847.	1848.	1849.	1850.	1851.	Average.
St. Just........	24·99	14·69	33·33	21·42	29·14	24·71
Lelant.........	35·87	24·48	16.85	40·67	22·00	29·97
St. Ives........	13·95	23·38	20·40	36·00	14·51	21·64
St. Buryan.....	7·69	26·08	4·54	0·00	12·00	10·06

From this table it appears that thoracic diseases in an agricultural district among females who can have little or nothing to do with mining operations, or agricultural pursuits, is less than one half as much as in the most favourable of the mining districts.

A table showing the ratio of chest affections in trades, &c.

Fisherman	0 in 4
Blacksmith........................	1 in 1
Coastguard........................	1 in 1
(A case of pneumonia.)	
Mason............................	2 in 3
Shoemaker........................	0 in 2
Miner	1 in 1

A table showing the rate of mortality below 5.

	Males.	Females.
1847	36·11	30·07
1848	47·16	17·39
1849	23·07	45·45
1850	59·09	37·50
1851	61·11	16·00

1852.

There died during the year 60; and of these 31 were males and 29 females.

Of the 31 males,—

12 were agriculturalists,

1 was a shoemaker,
1 „ smith,
1 „ boy of 11.

Of the 16 remaining, 12 were below 5 years of age, and 4 between 5 and 10.

Of the 12 agriculturalists,—

4 died of consumption = 33·33 per cent.
1 „ bronchitis = 8·33 per cent.
4 „ age, = 33·33 per cent.
1 „ diseased bladder,
2 „ fever,
1 „ scarlet fever.

Of the 29 females,—

3 died of consumption = 10·34 per cent.
8 died of age = 28·57 per cent.
3 „ dropsy.

The oldest male—a labourer— died at 71 years of age.

The oldest female died at 88 years of age.

About 38·70 per cent. of all males died below 5 years of age.

About 27·58 per cent. of all females died below 5.

1853.

During the year, 48 died; of these, 24 were males and 24 females.

Of the 24 males,—

8 were agriculturalists,
2 „ sailors,
1 was a carpenter,
1 „ mason,
1 „ shipwright.

Of the remaining 13, 9 died below 5 years of age, and 1 between 5 and 10.

Of the 8 agriculturalists,—

2 died of consumption = 25 per cent.
2 „ age,
1 „ lumbar abscess,

1 died of dropsy,
1 ,, diseased stomach,
1 ,, diabetes.

Of the 24 females,—

2 died of consumption = 8·33 per cent.
5 ,, age.

The oldest male, a farmer, died at 93 years of age.
The oldest female died at 85 years of age.
Of all males, 37·50 per cent. died below 5 years of age.
Of all females, 37·50 ditto.

1854.

During the year there died 52; of these, 29 were males and 23 females.

Of the 29 males,—

8 were agriculturalists,
2 ,, sailors,
1 was a pauper,
1 ,, unknown, drowned.

Of the remaining 17, 15 died below 5, and 2 between 5 and 10.
Of the 8 agriculturists,—

0 died of consumption,
4 ,, age, at 91, 88, 74, 72,
3 ,, dropsy, at 76, 74, 64,
1 ,, killed, at 27.

Of the 23 females,—

2 died of consumption = 8·69 per cent.
5 ,, age.

Of the remaining,—8 died below 5 years of age, and one between 5 and 10.
The oldest man, a farmer, died at 91 years of age.
The oldest woman died at 91 years of age.
Of all male deaths, 31·03 per cent. died below 5 years of age.
Of all female deaths, 34·78 per cent. died below 5.

1855.

There died during the year 40; and of these, 20 were males and 20 females.

Of the 20 males,—

9 were agriculturalists,
3 ,, fishermen,
2 ,, miners,
1 was a mason,

Of the remaining 10, all died below 5 years of age.

Of the 9 agriculturalists,—

1 died of consumption = 11·11 per cent.
5 ,, age, 90, 89, 82, 75, 71,
1 ,, abscess of the liver,
1 ,, disease of the stomach,
1 was killed.

Of the 20 females,—

4 died of consumption = 20·00 per cent.
6 ,, age, 91, 90, 82, 79, 69, 65, = 30·00 per cent.

The oldest male, an agricultural labourer, died at 90 years of age.

The oldest female died at 91 years of age.

Of all male deaths, 25·00 per cent. died below 5 years of age.

Of all females, 30.00 per cent. died below 5 years of age.

1856.

There died during the year 44; of these, 23 were males, and 21 females.

Of the 23 males—

10 were agriculturalists,
1 was a shoemaker,
1 ,, fisherman,
1 ,, miner.

Of the remaining ten, all died below 5 years of age.

Of the 10 agriculturalists,—

1 died of consumption = 10·00 per cent.
4 ,, age, 80, 80, 75, 74,

1 „ gastritis = 56 per cent.
2 died of fever,
1 was killed,
1 died of cancer of the stomach.

Of the 21 females,—

1 died of consumption = 4·76 per cent.
8 „ age, 90, 86, 81, 77, 76, 75, 75, 75,
1 apoplexy, 78,
and 6 died below 5 years of age.

The two oldest males died at 80, farmers.

The oldest female died at 90 years of age.

Of all males, 42·27 per cent. died below 5 years of age.

Of all females, 29·04 per cent. died below 5 years of age.

The statements given above of the sanitary condition of the agricultural population during the past five years, are confirmatory of what has been previously remarked in every year since 1837. The agricultural population is, as it regards thoracic affections, greatly more healthy than the mining classes. If St. Buryan be compared with St. Just, they occupy similar geographical positions, lie contiguously to each other, with the same climate, same vegetable productions, equally surrounded by the fresh air from the open ocean, and yet they are so widely separated as it regards health and longevity, that it becomes a matter for serious enquiry—why the agricultural districts are so very healthy, and why the mining districts are so unhealthy, and whether or not the mortality of the miner cannot be reduced.

During the past five years the frequency of chest affections may be seen by the subjoined table.

A table of mortality from thoracic affections in the mining and agricultural districts from 1852 to 1856.

Males.	1852.	1853.	1854.	1855.	1856.	Average.
St. Just.......	41·66	50·50	50·00	56·66	50·00	49·76
Lelant.........	61·90	56·62	60·71	52·16	60·00	58·27
St. Ives........	49·99	64·63	71·42	48·85	33·32	53·64
St. Buryan.....	41·66	8·33	8·69	20·00	4·76	17·55

In 1852 there is an equality between St. Just and St. Buryan, but in every other year the contrast is very great, and in the average of the five years, the deaths from chest diseases are more than three times as much in Lelant and St. Ives, as in St. Buryan.

A table of mortality from chest affections in females in the mining and agricultural districts.

Females.	1852.	1853.	1854.	1855.	1856.	Average.
St. Just..........	18·18	23·91	38·53	23·21	16·07	23·98
Lelant...........	29·59	40·81	41·01	34·69	18·41	32·90
St. Ives.........	16·34	39·53	45·70	28·19	33·32	32·61
St. Buryan......	10·34	8·33	8·69	20·00	4·76	10·42

The females in the agricultural districts are, again, more healthy than those in the mining ones. In the above table it will be seen that in the most favourable, St. Just, the mortality is more than twice as great as that observed in St. Buryan. This is also borne out by the number of children who died below 5 being much less in St. Buryan than any among the mining population.

Description of the Phalaropus hyperboreus, Pennant, shot near the edge of the pool, Swanpool, September 1845.

Length, 7 inches 5 lines; spread of wings, 14 inches 3 lines; bill 11 lines; black, slender, straight, somewhat depressed at the base, and slightly bent at the tip. Nostrils basal, lateral, oval, membraneous; irides rich brown; crown of head, nape, cheeks and sides of breast, deep ash grey; neck in front and sides reddish brown; breast, abdomen and under tail coverts white; back dark slate, with broad rusty-brown margins to the feathers; wing coverts black tipped with white, forming a bar; primaries nearly black—first and second quills longest secondaries lighter fringed with white; tertiaries edged with a yellowish rusty brown; from corpus to end of wings, 4 inches 2 lines; upper tail coverts white, mottled with dusky brown; tail 1 inch 10 lines in length—deep brownish-grey, edged with white—the two middle feathers four shades darker; tarsus 10 lines, flattened laterally; naked portion of tibia two-and-a-half lines; tarsi, toes and membrane dusky, with a greenish tinge; claws black. The anterior toes united up to the first joint by a strong web—the remaining portion furnished with tobated membrane, which was beautifully pretinated.

A specimen of this very rare bird was shot by Mr. Edward Williams, at Swanpool, September 16, 1853.

Dr. W. K. Bullmore informed me a few days since, that he had procured one from the same locality, and that it was now being mounted by our talented taxidermist, Mr. Philip Chapman, Webber-street.

September 23, 1859.

Contributions to the Falmouth Fauna.

By W. P. COCKS.

RATS AND MICE.

1859.

The wisdom and power of God appear in the multitude of living creatures, which he hath formed, and continues in being, through the constant care of His indulgent providence: nor are the least of these creatures neglected or forgotton. Naturalists who investigate the *works of God*, inform us, that by specific marks the genus and species of all creatures are carefully preserved; so that not only the being, but the distinctive tribes of animals are continued from generation to generation, which show forth visibly the infinitely diversified works of Almighty God. Not only hath he given being to an innumerable number of creatures, but also extends laws suited to the nature of every creature. *Rev. G. M'Cann.*

Rats and Mice are subterraneous in their habits, living together in extensive colonies. They are very destructive to the farmer, agriculturist and planter; burrowing up new-sown ground, destroying the seed, gnawing the bark of young trees, and attacking all sorts of grain.

When food is scarce in the fields and barns, &c., they enter dwelling-houses, &c., and commence pilfering and destruction: nothing is rejected by their accommodating stomachs. Rats, in particular, are an audacious and savage race. They eat one another, even without the stimulus of hunger. I have repeatedly taken from the "rat-trap" placed in the yard, fragments of a recently-captured rat—the head, nearly two thirds of the skin, the four paws and tail. In one instance, the head and tail and a fillet of skin from the back, were the only portions left.

Arnobius, a philosopher who lived in the reign of Dioclesean, in the third century, says:—Glance through the various annals written in different languages, and you will learn that all countries have frequently been desolated by them and abandoned by their cultivators. Every kind of produce is attacked and eaten by *mice* and *locusts*. Pass through your own histories, and you will be informed how the former age has been affected by these pests and brought to the miseries of poverty.

Class—MAMMALIA.—Cuvier.

Mammals are vertebrated animals, with warm and red blood; viviparous, and suckle their young with milk secreted by the mammæ of the mother.

Order—FERÆ.—Linnæus.

Four extremities proper for walking; feet armed with claws; mammæ abdominal, varying in number; stomach simple, membraneous; intestines short.

Family—INSECTIVORA.—Cuvier:—SORICIDÆ.—Swainson.

Feet short, armed with stout claws; those of the hind feet always with five toes, having their sole entirely bearing upon the ground; fore-feet generally with five toes; molar teeth studded with conical points; canines sometimes very long and sometimes very short; incisors variable in number.

Genus—SOREX.—Linnæus.

Incisors 2-2; false canines, or lateral incisors, 3 or 4-2. The two superior middle teeth crooked and indented at their base; molars, 4-4 5-5, crowned with points; head conical, muzzle produced, pointed; ears short, rounded; eyes small, perceptible; tail long and slender, often angular; legs short, feeble; toes furnished with crooked claws; teats six or eight; sebaceous gland on the flanks; fur soft, velvety.

ARENEUS.—LINN.

Fur soft, velvety; reddish brown above, pale brownish grey below; ears small, round, with two folds or lobes within; tail square, a little shorter than body. Gardens, hedges, &c. *Common.* Food, grain and insects. Produces from five to seven at a birth. *Buffon* observes:—This little animal has a strong and peculiar odour, which is very disagreeable to the cats, who pursue and kill, but never eat shrews. It is probably this bad smell and the reluctance of the cats, which have given rise to the *vulgar prejudice*, that the bite of the shrew mouse is venomous, and particularly hurtful to horses. The shrew ash, says *Gilbert White*, is an ash whose twigs and branches, when gently applied to the limbs of cattle, will immediately relieve the pains which a beast suffers from the running of a shrew-mouse over the part affected; for it is supposed that a shrew-mouse is of so baneful and deleterious a nature, that wherever it creeps over a beast, be it horse, cow, or sheep, the suffering animal is afflicted with cruel anguish, and threatened with the loss of the use of the limb. Against this accident, to which they were continually liable, our provident forefathers always kept a *shrew ash* at hand, which, when once medicated, would maintain its virtue for ever. A shrew-ash was made thus:—In the body of the tree a deep hole was bored with an augur, *and a poor devoted shrew-mouse was thrust alive, and plugged in*, no doubt, with several quaint incantations, long since forgotten. *The shrew is a pretty harmless little creature.*

G. fodens, PALL. Fur deep brownish black above, white below; ears small, provided with three small folds, capable of shutting it entirely; feet and tail bordered with stiff white hairs; tail square-shaped, a little shorter than body. *Produces from five to eight young at a birth.* Meadow near dog-kennel, Panscoth-lane, Budock bottom, &c.

G. remifer, GEOFF. Fur blackish brown above, greyish below; ears small, fringed with a tuft of white hairs; tail square at base, compressed at point; feet and tail bordered with greyish hairs. Meadow and boggy ground near Capt. Bull's estate, &c.

ORDER—RODENTIA.—CUVIER.—GNAWERS.

These animals attack the hardest vegetable productions, and frequently feed on wood, bark, roots, &c.

Two large incisors in each jaw, separated from the molars by a wide space; no canine teeth; molars with flat crowns or blunt tubercles: lower jaw articulated longitudinally, so as to move only backwards and forwards. Extremities.—The posterior longest, terminated by unguiculated toes, the number varying according to the species; mammæ variable in number; stomach simple; intestines very long.

The genera in which these eminences are simple lines, and which have the crown of the tooth very flat, are more exclusively fungivorous; those which have the eminences divided into blunt tubercles are omnivorous; and those which have points, more willingly attack other animals, and approximate a little to the *carnivora.*

The incisor teeth are prismatic in form, covered by enamel only on their anterior convex surface, and sloped or chisel-shaped at the end. They grow from the root as fast as they wear away at the edge, and should one happen to be displaced, the corresponding tooth of the other jaw, finding no obstacle to its growth, attains a monstrous length.

"We have," says Mr. Blyth, "seen one of these upper teeth thus prolonged, and gradually curling round, so as to destroy the eye of a rat."

These teeth are deeply embedded in the jaw and hollow internally; this cavity is filled with a vascular pulp, which makes constant additions of successive layers of new matter on the interior of the tooth, which advances to supply the part worn down. The membrane that secretes the enamel extends over that part of the tooth embedded in the jaw, and adds the enamel as the tooth advances. That part which at one period is contained in the jaw and would form the fang, is afterwards protruded, and constitutes the body of the tooth.

FAMILY—SCIURIDÆ.—BELL.

GENUS—MYOXUS.—CUVIER.

Incisors 2-2; canines 0-0 0-0; molars 4-4 4-4; divided by transverse bands; ears large and round; fore-feet with four toes and the rudiment of a thumb; tail long, round, with hair tufted or depressed; fur soft.

M. avellanarius, DESM. Fur fawn colour above, whitish below; tail length of body, slender, flattened, with hairs directed laterally. Produces from four to five at a birth.—Plantation, Presloweth, College Wood, &c.

The fat dormouse (*M. glis*, DESM.,) is used as food in Italy, as it was by the ancient Romans, who fattened them for the table. The dormouse resembles the squirrel in its manners and food.

FAMILY—MURIDÆ.—BELL.

GENUS—MUS.—LINNÆUS.

Incisors 2-2; canines 0-0 0-0; molars 3-3 3-3; molars furnished with blunt tubercles, the anterior the largest; fore-feet with four toes and the rudiment of a thumb; posterior with five, edged with stiff and close bristles; tail long, naked and scaly.

M. rattus, LINN. Fur blackish above, deep ash coloured below; ears oval, broad, naked, half the length of head; tail longer than head and body. Produces from six to eight at a birth, and litters several times in the year. *Rev. Dr. Fleming* states,—"I have evidence of the bringing forth 11 young ones at a litter, and of their pulling the hair off the necks of cows to line their nests.

Var, COOKS. Fur black, very long, fine and silky; caught in the neighbourhood of the gas-house. Originally from India.

"The remarks of Mr. Pennant," says the Rev. Dr. Fleming, "have led to the supposition that this species is now nearly extirpated by the brown rat, which he considers as its natural enemy. He does not mention his evidence of enmity between the species. On the contrary, I know that they have lived for years under the same roof; the brown rat chiefly residing in holes of the floor, the others chiefly in holes in the roof.

"Since Louis Phillippe left the Tuileries, the place has been uninhabited; for a vast multitude of black and brown rats have established an immense colony in the cellars of the once royal castle. Some old shoes, old hats, and some sacks of potatoes which had been left there, have, up to the present time (1851,) amply served them for provisions; and as there is a direct communication between the cellars and the river Seine, they had everything they required to lead a very joyous life. Recently, however, they have been making excursions into the houses in the Rue de Rivoli, and the inhabitants having made a complaint to the Prefect of the Seine, orders were given to the person charged with the destruction of the vermin, to organize a rizzia against the intruders. It is said that on entering the cellars, he found a complete mass of these black and brown rats, which formerly were said to be mortal enemies, but now are living on fraternal terms; and in consequence of crossing the breeds, many of them were dark on the backs, with white bellies and tails. The skins of this race are considered valuable. The night before last, the ratcatcher of the capital commenced setting his traps, and on the following morning he had caught 847 rats. According to custom, their tails were cut off and sent to the Hotel de Ville, in order to support the claim for the usual reward."—*The Rat, by J. Rodwell.*

Decumanus, PALL. Fur greyish-brown above, whitish below; ears as broad as long, rounded, naked; one-third length of head; tail shorter than the head and body. It produces from ten to fourteen at a birth; Dr. Fleming says nineteen; Pennant fourteen to eighteen; Buffon twelve to fifteen and sometimes nineteen; Stewart from twelve to nineteen.

Originally from Persia or India, and was not known in England previous to the year 1730.

Var, COOKS. Fur short, dark yellowish-brown above, white below; head large, depressed on the crown; neck short, thick; nose truniated; ears large, naked, rather more than one-third length of head; eyes large, prominent; length of body and head five-and-a-half inches; depth at chest one inch and six-eighths;

tail four inches and three-eighths in length, naked; teeth blunt, of a dark ochre colour; whiskers long, strong and greyish, feet and toes very large; claws blunt, worn; testes large.

The second specimen was a female, not quite so large; the uterus contained eight fœtuses.

Trevathan lane, near Mr. Edey's slaughter-house.

The brown rat is carnivorous, bold, ferocious, and most destructive in the game preserve and poultry yard, where the eggs and young birds are preyed upon by them without mercy. In towns, carrion and offal form their chief subsistence. An official report to the French Government, on the proposition for removing the establishment for slaughtering horses at Montfaucon, gives an account of their numbers and voracity almost appalling; indeed, one of the chief obstacles urged against such a removal was the fear entertained of the dangerous consequences that might result to the neighbourhood from suddenly depriving these voracious vermin of their accustomed sustenance. The report goes on to state, that the carcasses of the horses killed in the course of the day, amounting sometimes to 35, are found the next morning picked bare to the bone. A part of this establishment is enclosed by solid walls, at the bottom of which several holes are made for the entrance and exit of these vermin. In this enclosure the proprietor, Dusuassois, put the dead bodies of two or three horses; and towards the middle of the night, having first cautiously, and with as little noise as possible, stopped up the holes, he got together several of his workmen, each having a torch in one hand and a stick in the other, suddenly entered the enclosure and closed the door behind them, and then commenced a general massacre. Wherever a blow was directed, even without aim, a rat was killed, and those which attempted to escape by running up the walls, were quickly knocked down. The dead of one night amounted to 2,650; the result of four hunts was 9,101; and repeating the experiment at intervals of a few days, he destroyed 16,050 rats in the space of a month. Even this can give but an imperfect idea of the number of these vermin, for the enclosure in which they were thus killed contains not above the twentieth part of the space over which the dead bodies of the horses are spread, and which, it is but fair to suppose, must equally attract the rats upon all points.—*Jesse's Gleanings of Natural History.*

It was reckoned that in Jamaica they consumed a twentieth part of the entire crop, and 30,000 were destroyed in one year in a single plantation.—*Quarterly Review*, 1857.

Sir Charles Price, who had an estate in this island (Jamaica) infested by rats, imported with much trouble, a very large and strong species for the purpose of extirpating the others. The new comers answered his purpose to a miracle; they attacked the native rats with such spirit, that in a short time they had the whole property to themselves; but this single species is now a greater nuisance to the island than all the others before them were together.—*Lewis's Journal.*

I will not (says Rodwell) give my own account of the number of rats destroyed yearly in London in matches and private practice, but prefer giving and substantiating, as near as may be, the calculations of Mr. Henry Mayhew. After the deepest investigation, he came to the conclusion that there were no fewer than 104,000 killed annually in London in public matches and private training; that is at the rate of 2,000 per week. At the same time bear in mind that nearly the whole of these are professedly country rats, all of which are caught on the farms, &c., in the outskirts of London.

Now, if a few individuals from the outskirts can supply the London market with 2,000 rats per week the year through, pray what must be the state of the entire country? Still it may be said that some of them are sewer rats. That doubtless, is true; but from the best information I could arrive at, and for reasons I have already stated, I am satisfied that not four out of a hundred are caught in the sewers. But, to make it satisfactory and at the same time more easy of calculation, I will set them down at 4,000 in the year, thus leaving 100,000 to be brought from the outskirts; or, more plainly speaking, common barn rats. Let us now suppose ratcatching, &c., in London, to be suspended for one year only, and calculate the amount of food they would consume during that period, and then we shall see a portion of the *benefit conferred upon mankind by their destruction*. Thus 100,000 rats, at 10 rats per man, would eat as much food as 10,000 people. Then, if we calculate them at the wine-glass standard, it would take 200 bushels, or 25 quarters per day, to supply them with a wine-glass of grain each, at strike measure; and which, in the year, would amount to 9,125 qrs. Or if we calculate it in the shape of bread supposing two pounds of flour to make only two pounds of bread—it would supply 6,400 poor people with a two-pound loaf each daily, the year round. Moreover, the land necessary to grow the corn—say good land—yielding a fair average crop, namely, eight coombs, or four quarters to the acre, would amount to 2,281 and a quarter acres, which would employ eleven farmers—ten to 200 acres each, and the eleventh at 281 and a quarter; and all this to keep the rats that are destroyed in London in one year in dog-training and rat-pitting. We have not reckoned what the grain would cost. Suppose we calculate as before, oats, barley and wheat together, and set it down at 50s. per quarter; then we shall find that to give these rats a wine-glass of grain each, it would cost £22,812 10s. for the year. But bear in mind that this is all without any consideration of the young produced during the same period. Therefore, if we calculate them as before, namely, one-half females, to have five litters in the year, beginning and ending with a litter, and eight young ones at a birth, and the young to breed at six months old, then what would be the amount of living rats to be supported out of the farmer's corn and the poor man's loaf in the outskirts of London?

No less a number than 9,000,000, which, at ten rats per man, would eat, day by day, the year round, as much food as would supply 900,000 people for the same time. That is nearly one-third the population of London and its suburbs, or nine times the number of the British army, if we estimate it at 100,000 strong. Then, if we reckon them according to the wine-glass standard, what would be the amount of grain necessary to feed them for one day? Why, 18,000 bushels, or 821,250 quarters per year; which, if made into bread, would supply 576,000 human beings with a two-pound loaf each daily, for the same period. The ground necessary to grow the grain, at eight coombs, or four quarters to the acre, would be 205,312 and a-half acres; and this would employ 410 farmers at 500 acres each, and 312 and a-half for another. And what amount of money would it take to purchase this mixed grain, at 50s. per quarter? No less a sum than £2,053,125; all of which has been most happily and most effectually saved through the destruction of the parents in the rat-pits, &c., in London.

M. le Vicomte Querhoent, says *Buffon*, has favoured me with the following remarks:—"That the rats transported from Europe to the Isle of France, increased to such a degree, that, it is alleged, they made the Dutch leave the island."

Encounter with Rats in a Chinese House.—In my lodgment I had been anticipated by a populous colony of rats and mice. The size of these visitors was certainly monstrous, as their number was overwhelming; and there was no keeping them out during the night. The tricks they played, too, showed no little daring; and not inappropriately they have been designated "the cavalry of Ningpo." The dexterity with which they bounded from beam to rafter was surprising. They were equally expert in rattling over my furniture at pleasure; and they seemed to scour, in regimental squads, every nook and corner of the apartment. Their squeals of pleasure as they pitched into my provisions, were truly amusing. But it was not the least nuisance, just when one was dropping off to sleep, to be aroused by having the face licked by their slimy tongues or pawed by their cold extremities.—*Life in China, by Rev. Wm. C. Milne, M.A.*

Rats used as food.—The Jews were so oppressed with famine during the siege of Jerusalem by the Romans, that they were compelled to eat dogs, mice and rats.—*Isaiah* LXVI.

In China, dried split rats are sold as a dainty. A correspondent in the *News of the World*, April 4, 1858, states:—"As we near the southern parts, passing under the wall of the old city, we come upon lower neighbourhoods, and the shops are adapted to the wants of the waterside population. Here (if you observe curiously the shops which are filled with sun-dried comestibles the Chinese love,) you may find dried rats with their tails fully projected, and leaving no doubt of their class and order in creation. The rats are field rats, caught and dried after harvest."

The chiffonniers of Paris feed on them without reluctance. Nor is rat-pie altogether obsolete in our own country. The gipsies continue to eat such as are caught in stacks and barns, and a distinguished surgeon of our time, frequently had them served up at his table.

An old captain in her Majesty's service informs us, that on one occasion, when returning from India, the vessel was infested with rats, which made great ravages among the biscuits. Jack, to compensate for his lost provisions, had all the spoilers he could kill, put into a pie, and considered them an extraordinary delicacy.—*Quarterly Review*, 1857.

At the siege of Malta, when the French were hard pressed, rats fetched a dollar apiece; but the famished garrison marked their sense of the excellence of those which were delicately fed, by offering a double price for every one caught in a granary.—*Ib.*

"These vermin, (rats) are in request in some parts of Jamaica, and sold among the negroes for twopence halfpenny apiece. I have seen a gentleman who once passed them off for guinea-pigs in a pie; and where they live almost exclusively on sugar-canes, perhaps the negroes are right in considering them dainties.—*Williams's Tour in Jamaica.*

In Dr. Akin's *Athenæum*, published in the year 1807, there are three methods proposed for lessing the number of rats:—

1st.—*Introduce them at table as a delicacy.* They would probably be savoury food, and if nature has not made them so, the cook may. Rat pie would be as good as rook pie; and four tails intertwisted like the serpents of the Delphic tripod, and rising into a spiral obelisk, would crest the crust more fantastically than pigeons' feet. After a while they might be declared game by the legislature, which would materially expedite their extirpation.

2nd.—*Make use of their fur.* Rat-skin robes for the ladies would be beautiful, warm, costly, and new. Fashion requires only the two last qualities; it is hoped the two former would not be objectionable.

3rd.—*Inoculate some subjects with the small-pox or any other infectious disease, and turn them loose.* Experiments should first be made, lest the disease should assume in them so new a form as to be capable of being returned to us with interest. If it succeed, man has means in his hand which would thin the hyenas, wolves, jackals, and all gregarious beasts of prey.

N. B.—If any of our patriotic societies should think proper to award a gold medal, silver cup, or any other remuneration to either of these methods, the projector has left his name with the editor.

The *Rev. Mr. Ferryman*, walking out in some meadows one evening, "observed a great number of rats in the act of migrating from one place to another, which it is known they are in the habit of doing occasionally. He stood perfectly still, and the whole assemblage passed close to him. His astonishment, however, was great, when he observed *an old blind rat, which had a piece of stick at one end in his mouth, while another rat had hold of the other end of it, and thus conducted his blind companion.*"—*Jesse.*

A curious incident.—"A few days ago, a Glasgow gentleman, while standing on Strone pier, heard an unusual sound proceeding from below, and on looking down, he saw a water-rat in the claws of a large crab. The rat occasionally brought his antagonist to the surface, when the latter seemed to give him a sharper nip, as the rat no sooner got above the water, than he squeaked dolefully and began to sink again. Victory remained with neither, for the gentleman gave the crab a gentle tap with his stick, when our crustaceous friend let go and sank to the bottom in a great flurry, while the rat swam to the stonework of the pier and bolted into a hole."—*Glasgow Paper, May* 1858.

"I have seen at Anjar, in Cutch," says *Lieutenant Burnes*, "an establishment of rats, conjectured to exceed 5,000 in number, which were kept in a temple, and daily fed with flour, which was procured by a tax on the inhabitants of the town."—*Journal of the Royal Asiatic Society.*

Singular recovery of a marriage ring.—About the end of July last, the wife of a miner named M'Lean, at Clifton, near the head of Loch Lomond, lost her marriage ring whilst engaged in putting in or building peats; and notwithstanding that every search was made for it at the time, it could not be found. About a fortnight ago a cat brought a rat into the house, and around the neck of the rat was the missing marriage ring. It is supposed, as rats are known to carry off coins or pieces of silver or gold, that the ring had been taken to the rat's nest, where it had gone over the neck of one of the young ones, and remained there until the animal had advanced in growth, and curiously enough been captured by the cat.—*News of the World*, January 9th, 1859.

Robbery by rats.—A month ago a leather purse, containg 13 sovereigns and a £5 note and some silver, was stolen from the shop of Misses Rippen, 17, Pilgrim-street. The Misses Rippen reside at Windmill-hills, Gateshead; and before leaving the shop at night, they had placed the purse containing the money in a box underneath one of the counters. The next morning the purse was gone, and for some time its disappearance was involved in mystery. At length it was suggested that probably the rats might have removed it. A search was made, and although the boards of the floor were taken up, as also those of the adjoining shop, belonging to Mr. Pigg, tailor, no clue was found to the missing property until Thursday, when it was discovered safely lodged underneath the passage of Miss Jeffrey, which lies between the two shops. With the exception of a little having been nibbled off one corner of the purse, the owners received back the full amount they had so curiously lost.—*Gateshead Observer*, Feb. 27, 1859.

Rat killing extraordinary.—A gentleman living in Wales, aided by his two juvenile brothers, killed no less than 170 rats in less than half-an-hour by the use of lime. The three brothers poured some water into some quicklime, and, after stirring it, poured it into the rat holes, when out dashed the rats, heels over head, one over the other, and were as quickly killed by sticks which the youths held in their hands. No dogs whatever were used upon the occasion, and the dead rats filled a bushel basket.—"*Rats, by Uncle James.*"

Extraordinary catch of rats.—A few days ago, in a field occupied by Mr. Thomas Fairman, in the parish of Westwick, from one oak tree, in the midst of the roots, there were killed 112 rats.—*Ipswich Express*, August 22, 1858.

Death by the bite of a rat.—At a recent trial of dogs in a rattery, one of the rats escaped the farrier and got below a chair upon which one of the fancy happened at the time to be sitting. The man, wishing to expose the rat to the dog, put down his hand; the animal, however, taking offence at the liberty used, bit his thumb. Thinking the matter slight, that the bite was a simple scratch, he allowed it to go on for a few days unnoticed, till dangerous symptoms appearing, he became alarmed, and was obliged to go into the hospital, where, mortification having ensued, the man in a short time after died perfectly insane.—*North British Mail*, June 1858.

M. musculus, LINN. Fur dark grey above, cinerous below; ears oval, rounded, half the length of head; whiskers long and slender tail shorter than body. Produces from six to seven at a birth. The *Rev. Mr. Flemming* states—"We have found seventeen young ones in a nest, all nearly of the same size, and blind."

"There are few animals," says *Bell*, "more generally associated with mankind, or whose very existence appears to be more essentially dependent upon human arts and human civilisation, than this pretty, but annoying little pest." When in small numbers they are scarcely injurious, yet, owing to their fecundity, they soon become very destructive.

Aristotle tells us, that having shut up a pregnant female of the common mouse in a closed vessel filled with grain, he found after a short period no less than a hundred and twenty mice, all sprung from the same mother.

The domestic mouse of the Arabs, says *Chricton*, resembles our own; but according to *Ali Bey*, they are more fierce and troublesome. "I never saw," says he, "any mice so bold as those of Mecca. As I had my bed on the floor, they danced and leapt upon me every night. I gave them some blows, which made them fly." In spite of this warning, however, they returned to the charge and bit his fingers, having been attracted by the smell of some balm of juniper which he had been handling and had neglected to wash off.

Mice can easily be tamed, particularly if taken when young; but they can also be taught to approach with confidence, and to gambol about the room without running off to their holes. I have had several tame mice, one of which used to sit on my hand, and permit me to carry it about so seated, or it would hide itself under a fold of my coat, or creep up the sleeve for the sake of the warmth. In general, brown mice are easier to tame than their white relations. I have seen a common short-tailed field mouse come to the bars of its cage, and take a grain of wheat from the finger. The best way to tame them, is to inflict a forced fast of a day or so, and then to feed them from the hand, always taking care to accompany the operation with the sound intended to be the call. They will soon learn to connect the sound and the food, and will come to the side of their cage the moment that they hear it.—*Rev. Mr. Wood.*

Sylvaticus, Linn. Fur reddish grey above, whitish below, with a light brownish spot on the breast; ears broad, rounded, half the length of head; tail shorter than body. Produces from seven to ten at a birth.

Although extremely timid, it may be easily tamed. "I have seen," says *Professor Bell*, "several of them running out on the breakfast table of my late most valued friend *Dr. Leach*, of whose kind and affectionate disposition they appeared to have an almost instinctive perception, as they would feed from his hand or from his plate without the least fear, and allow him to handle and play with them as freely as the dormouse."

If provisions fail during the year, the strong devour the weak. I once kept a dozen of these mice in a cage, and furnished them with food every morning at eight o'clock. One day they were neglected for about a quarter of an hour, when one of their number was eaten up by the rest; next day another suffered the same fate; and in a few days, one only remained; all the others had been killed and partially devoured, and even the survivor himself had his feet and tail mutilated.—*Buffon*.

The great damage done to our fields by the hogs rooting up the ground, is chiefly owing to their search after the concealed hoards of the field mice.

Messorius, SHAW. Fur light reddish brown, mixed with yellowish above, white below; ears broad, rounded, one third length of head; tail shorter than body. Produces from five to nine at a birth. *Not uncommon*.

Gilbert White, in a letter to *Pennant*, says:—"As to the small mice, I have further to remark, that though they hang their nests for breeding up amidst the straws of the standing corn above the ground, yet I find that in the winter they burrow deep in the earth and make warm beds of grass; but their grand rendezvous seems to be in corn-ricks, into which they are carried at harvest." *This is the smallest of British quadrupeds, two of them weighing about the third of an ounce.*

Jonathan Couch states in his interesting work, *Illustrations of Instinct**—"The nest of a little grass mouse *(M. messorius)* was discovered in a garden, as it was supported a little above the ground on the stalks of grass, the weeds having been cut down by which it had been sheltered; and when it was examined and found to contain seven young ones not yet able to see, the whole was replaced as much as possible in the same situation, the only difference being that it was more exposed to observation than before. In a very short time the parent revisited her nest, but presently retired; and she was observed to nibble blades of grass, and run off with them under the weeds which still remained standing. Though closely watched in this proceeding, her precise object was not immediately perceived; but at last, being detected in conveying away a young one, the nest was re-examined, when the discovery was made that all of them had been removed, the whole transaction having taken place in the space of five minutes."

* Published by John Van Voorst, London.

Family—CASTORIDÆ.—Bell.

Genus—ARVICOLA.—Desm.

Incisors 2-2; canines 0-0 0-0; molars 3-3 3-3; molars with a flat crown and angular plates of enamel; ears small; muzzle obtuse; anterior toes with nails; hind feet not furnished with lengthened hairs; tail long, round, hairy, almost the length of body.

A. amphibius, Desm. Fur reddish brown, slightly mixed with grey above, yellowish grey below; head large, round; nose thick, blunt; eyes small; ears short, scarcely conspicuous beyond the fur; incisors large, chisel-shaped, yellowish brown in front; tail black, half the length of the head and body. Produces from five to seven at a birth. It inhabits the banks and ditches, &c., in the neighbourhood. It swims and dives well, and feeds exclusively on roots and aquatic plants. "As a neighbour was ploughing in a dry chalky field, far removed from any water, he turned out a *water-rat*, that was curiously laid up in a hybernaculum artificially formed of grass and leaves. At one end of the burrow lay about a *gallon of potatoes* regularly stowed, on which it was to have supported itself for the winter.—*Gilbert White.*

The peasants in France, says *Buffon*, eat it on maigre days.

Agrestis, Flem. Fur reddish-ash colour above, paler below; ears small, round; muzzle obtuse; tail one third the length of body and head; produces from five to seven at a birth. The depredations committed by this insignificant little creature, in the corn-field, rick-yard, granary, and plantation, are often severe, and sometimes overwhelming.

An extraordinary instance of the rapid increase of mice and the injury they sometimes do, occurred a few years ago in the new plantations made by order of the Crown in Dean Forest, Gloucestershire, and in the New Forest, Hampshire. Soon after the formation of these plantations, a sudden and rapid increase of mice took place in them, which threatened destruction to the whole of the young plants. Vast numbers of these were killed—the mice having eaten through the roots of five-year-old oaks and chesnuts, generally just below the surface of the ground. Hollies, also, which were five or six feet high, were barked round the bottom; and in some instances the mice had crawled up the tree, and were feeding on the bark of the upper branches. The number caught in the different enclosures in Dean Forest, in three months, from September to January, was 28,071.—*Jesse's Gleanings.*

Sennacherib, king of Assyria, son and successor of *Shalmaneser*; B.C. 714, attempted to invade Egypt, but was defeated by an army of *Mice*. "On their arrival at Pelusium," (a city of Egypt at the mouth of the eastern arm of the Nile, that nearest to Palestine), says *Herodotus*, "so immense a number of mice infested by night the enemy's camp, that their quivers and bows, together with what secured their shields to their arms, were gnawned in pieces. In the morning the Arabians, finding themselves without arms, fled in confusion, and lost great numbers of their men." There is now to be seen in the temple of *Vulcan*, a marble statue of this king, having a mouse in his hand.—*Lib. II., C.* 141.

A similar visitation befel some of the *Teneri*, as they lay encamped during the night time, near *Amaxitus*, a town of Troas. Troas or the Troad signifies the whole country of the Trojans, the province where the ancient city of Troy had stood.

When the *Philistines* took the ark of God from the Israelites, they carried it to *Ashdod*, a strong city on the south-east coast of the Mediterranean, and placed it in the temple of their god Dagon, for which they were smitten with a painful disease (hœmorrhoids), and multitudes of mice.

"But the hand of the Lord was heavy upon them of Ashdod, and he destroyed them, and smote them with *emerods*, even Ashdod and the coasts thereof." 1 Sam. v. 6. To remedy this suffering, and to remove the ravages committed by *mice*, says *Herodotus*, which wasted their country, the Philistines were advised by their priests and soothsayers to return the ark of God, with the following offerings (1 Sam. vi., l. 11): five figures of a golden emerod, that is, of the part afflicted and five golden mice, hereby acknowledging that this plague was the effects of Divine justice.

At *Angerville*, in France, whole farms have been given up to the proprietors, in consequence of the damage done to the property by the field mice.

M. Varro states that the natives of Gyarus, an island of the Cyclades group, a place of exile, in the time of the Roman Emperors, had been driven out by mice.—*M. Varro*, born at Rome, B.C. 116; died B.C. 27. He was one of the most extraordinary men that ever lived. He wrote no less than 500 volumes on different subjects.

In the *Mirror* for 1836 it is stated that the village of Helgay, near Downham, in Norfolk, is once in three or four years infested with an incredible number of mice.

The villages of Putschwitz, Kleimbautzen, Walswitz, Glenin, and Kennewitz, about a mile distant from Bautsen, were reduced to a most deplorable state, in the autumn of 1773, by the field mice having devoured all the produce of the soil.—*Annual Register.*

There is a meadow in Wiltshire, says the Rev. Mr. Wood, where, by watching almost any square yard of grass, a short tailed field mouse is nearly sure to be found. Yet that field had been used for cricket, hockey, football, and many other games for a long time before any one discerned a single mouse.

Extract from a Frankfort Journal.—Our fields have been so overrun with mice that in one commune near 20,000 of those little pests have been destroyed. It is impossible to form an idea of the destruction they commit. No sooner is the harvest over, than they betake themselves to the vineyards, where they make a greater devastation than amongst the corn.—*Times*, 1834.

The province of Hamah, says *Burckhardt*, is the granary of Northern Syria, though the harvest never yields more than ten to one, chiefly in consequence of the immense number of mice, which sometimes wholly destroy the crops. Throughout Syria the field mice commit dreadful havoc in the cultivated fields in those years when there has been little or no frost in winter.

Dr. Livingstone states, on the 31st of July we parted with our kind *Libonta* friends. We planted some of our palm-tree seeds in different villages of this valley. They began to sprout even while we were there, but unfortunately they were always destroyed by the mice which swarm in every hut.

The fate of Bishop Hatto in the Mausethurm or Mouse Tower, near the foot of the Ruppertsberg, in the Rhine.—This tower, rising from the surface of the river, is traditionally related to have been erected by *Hatto*, the second Archbishop of Mayence, as a place of refuge from the innumerable quantities of mice that infested his palace, and which were considered a heavenly visitation on account of his avariciousness and obduracy. Even here the prelate was followed by his diminutive, though dreaded assailants, and is stated to have been eventually destroyed by them in the year 970.

Moses declared the mouse to be unclean. "These also shall be unclean unto you among the creeping things that creep upon the earth the weazel and the mouse," &c.—Leviticus xi., 29.

"They that sanctify themselves and purify themselves in the gardens behind one tree in the midst, eating swine's flesh, and the abomination, and the mouse, shall be consumed together saith the Lord." Isaiah, lxvi. 17.

Addenda.

August 20, 1859.—Mr. George Pender caught a fine specimen of the Locusta Migratoria, Lin., when at Budock Vean. Early in the months of September he found a second specimen in the same locality.

August 31.—One was captured by Pascoe, gardener in Capt. Bowden's garden.

September 2.—One was taken alive in the Messrs. Olver's timber-yard, by Mr. Teague, jun..

September 17.—Captain Mansell's son saw one at Mainporth, but was unable to capture it.

September 4.—One was found in a field near the Bowling Green, Woodlane.

September 17th.—A fine specimen of the Phalaropus Hyperboreus, Pem. was shot at Swanpool; in the possession of Dr. W. K. Bullmore.

Addenda to Falmouth Fauna.

Testacella Magnei, Ferun. Body one inch long, three-eighths broad and three-eighths in depth, oblong, very firm, contracted, slightly gibbous, truncated anteriorly; divided into four nearly equal parts by five furrows (? vessels) running parallel to each other from the veil under the shell to the anterior margin of the mantle; three on the superior or dorsal portion of the body, and two laterally—one on each side, the space between them intersected by numerous tortuous ramifications, giving the whole surface a leaf-like appearance. Mantle dark slate, shading into black on the upper surface of sides and back,—margin, pale buff; *veil* or *gelatinous tunic*, greyish—white sprinkled over with minute dark spots, retractile; foot orange red, corrugated, with a crenated margin; shell three-eighths and one-sixteenth of an inch long, by two-eighths in diameter, attached externally to posterior extremity, of a light greyish white, solid, subtruncated oval, lines of growth deep; epidermis destroyed, convex surface partially polished, wormed. The body varnished with a transparent viscous matter. The creature was dead when delivered to me on the 5th of this month. Found alive in a garden in Woodlane last week. In the possession of Master William Squire.

First noticed by M. Dugue, in a garden at Dieppe, in 1740. Native of the Island of Teneriffe.

A beautiful specimen of the Death's Head Moth (*Acherontia atropos, Ochsen*) was caught this week by Miss Stephens, in the shop of Mr. George Wade, confectioner, &c., Ludgate Hill, Falmouth. It measured five inches in spread of wings, and the length of body was two and a quarter inches.

The Alpine Swift (*Cypselus Alpinus*, Selby), was shot by R. A. Daniel, Esq.,) at Mylor, on the 24th of October. This very rare bird is in the possession of Mr. R. Main, animal preserver, &c., Ludgate Hill, Falmouth.

On a new form of Telegraph Cable, intended to obviate the mischievous effects of induction, and otherwise improve the insulation and mechanical character of the cable.

By J. N. Hearder.

The failure of the Atlantic Cable has given rise to a variety of suggestions and contrivances, for obviating the difficulties and remedying the defects which were then discovered to exist in the system of submarine telegraphy. The principal of these were the difficulty of perfect insulation, the retarding effect of induction, and the want of sufficient strength, combined with a consistent degree of weight and size.

The form of cable now proposed, samples of which accompany this communication, is intended to remove these difficulties as far as possible, by combining the desiderata of increased conducting capacity, perfect insulation, diminished susceptibility of inductive action, mechanical strength and lightness, and perfect facility of recovery after immersion. The theoretical principles involved in the construction of this cable being first explained, the modes adopted to attain the object will be better appreciated. 1st—Conductor.—It is a well established law that the resistance of conductors is directly as their length and inversely as their mass, or transverse sectional area. This being admitted, it becomes self-evident that the mass of a conductor should increase with its length up to a point which shall require the use of electro motors or voltaic batteries of moderate size. Small conductors require batteries of high intensities, which endanger the insulating coatings, and increase the amount of inductive action and static charge, the mischievous effects of which will be hereafter noticed; hence the reason for employing a conductor very much larger than the one originally used in the Atlantic Cable. 2nd.—Perfect insulation. Gutta percha both from its mechanical and electrical properties is admirably adapted for insulating telegraph cables. Perhaps its almost single defect is that it occasionally contains small fissures, through which the electrical current leaks out and is lost. India rubber may be used, and when joined up so as to prevent leakage, is perhaps as efficient as gutta percha. In the process of insulating the present cable however, another insulating compound is used in connection with the gutta percha, which is adhesive and plastic, serving to bind together the surfaces with which it comes in contact, and to fill up fissures when submitted to heavy pressure, thus serving to repair injuries resulting from undue straining or bending the cable. 3rd—Mode of lessening the mischievous effects of inductive action. The conductor of a submarine cable is under very different conditions from those of a wire freely suspended in the atmosphere, the latter may be compared to the prime conductor of an electrical machine, and the former to the inner coating of a Leyden Jar of which the outer coating is represented by the sea. The freely insulated wire permits the uncontrolled action of the electricity which is sent into it, the only opposing element being the resistance of the wire. The conductor of a submarine cable not only opposes resistance to the passage of the current, but throws off portions of that current in the way of static charge, to the surface of the insulating medium by which it is surrounded, thereby controlling and lessening the power of that current in its action at the remote end. In addition to this the static charge thus taken up, returns to the wire again after the current of the battery has been discharged, and produces a second or prolonged defect which requires a certain time for its entire subsidence, thereby interfering seriously with the rapidity of signalling. The amount of this static charge thus taken up and the effects which it produces in discharge are governed by the same laws as those which govern the action of the Leyden Jar. The following are a few :—

1st. Other things being equal, the amount of charge which any coated surface can take up, will be in the direct ratio of the thickness of the dielectric, when flat or nearly equal opposed metallic surfaces are employed. What the ratio is between the amount of charge and the thickness of a cylindrical dielectric of so small an internal diameter as a submarine cable is not yet properly made out.

2nd. The thickness of the dielectric being the same, the static charge will increase with the intensity of the charging element.

3rd. The effects of electrical discharges are as the squares of their quantities.

4th. The effect of an electrical discharge is lessened and almost lost by interposing a fibrous or porous substance between the dielectric and its metallic coating, or by destroying the homogeneity of the dielectric itself.

As these laws are universally recognised, with the exception perhaps of the last, which has not been so much investigated, it will be necessary only to exemplify this one by some experiments which bear upon its application to the new form of cable.

Let a plate of glass be coated on each side with tin foil in the usual manner. If it be now charged and then discharged through a thermo electrometer the effect of the discharge may be noted. If the tin foil coatings be now removed, and the thickness of paper, silk, cotton or any other fibrous substance be inserted between them and the glass, the whole may be charged and discharged as before, the same quantity of electricity may be thrown on and the length of the spark in discharge will be the same for the same quantity, but the effect on the thermo electrometer will be reduced in an extraordinary manner. Again if the coated dielectric consists of two plates of glass coated on the outsides only, forming a plate of double thickness, they may be charged and discharged, and will also produce a certain effect upon the thermo electrometer, but if a layer of cotton, paper, &c. be inserted between the two plates of glass, the effect on the electrometer will suffer a corresponding diminution.

It was a practice amongst some of the earlier electricians to coat Leyden Jars with paper previously to putting on the tin foil, under the idea that jars thus coated were less liable to fracture by spontaneous explosions through the glass. Jars, however, thus coated lose nearly three-fourths of their thermal power.

As thermal and magnetic effects are dependent almost entirely on the same causes, the loss of one is equivalent to the loss of the other, and the author thus considered that this law might be rendered available in reducing the static or magnetic effects resulting from the residual charge, which returns to the wire from the gutta percha surface in contact with it, and confuses the indications of the telegraph instruments.

Upon this principle it is only necessary to alternate porous or fibrous layers with the layers of insulating material, in such a manner, of course, as should not interfere with the mechanical qualities requisite to be ensured. A little reflection showed that, by the judicious employment of these fibrous layers, the mechanical as well as the electrical qualities of the cable would be vastly improved.

The fibrous material which, after careful investigation, has been fixed upon, is a very superior description of soft flax twine, loosely twisted, so as not to be capable of stretching. These twines are laid on side by side in a very long spiral direction, about the turn in six inches, and are passed through a matted insulating compound of resinous or bituminous substances, which becomes adhesive and plastic when cold, and thus binds them firmly together and to the surface of the gutta-percha.

The relative situation of the fibrous layers and gutta-percha may be varied, as will be seen by the samples accompanying this communication.

No 1 consists of a wire strand, containing 7 wires of No. 17 wire guage, and weighing about 340lbs. to the mile. This is covered first in the ordinary way,—with one coating of gutta-percha, then with two layers of twine and adhesive insulating composition,—the layers of twine being laid on in opposite directions, so as to prevent twisting when strain is applied, and containing respectively 22 and 28 strands of twine. The whole is then covered with two extra coatings of gutta-percha; and, if necessary for additional protection, it may be covered again with hemp and wire, but this does not belong to the invention. Specific gravity of sample, 1·336; weight per mile, about 1,290 lbs., or eleven and a half cwts.

Sample No. 2 consists first of a wire strand coated with a layer of 14 strands of twine and adhesive compound, laid on in a direction reverse of the twist of the wire. Secondly, one layer of gutta-percha. Thirdly, another layer of twine in the direction opposite to the first; and lastly, two layers of gutta-percha. Specific gravity, 1·373; weight per mile, 1,320 lbs., or eleven and three-quarter cwts.

No. 3 is the same as No. 2, omitting the first layer of twine next the wire, so that it has—first, the layer of gutta-percha, then the layer of 22 strands of twine, and lastly, two layers of gutta-percha. Specific gravity, 1·494; weight, 935 lbs. to the mile, or rather over eight and a quarter cwts. The cable, as it receives the coating of twine and adhesive compound, passes through an equalizing die, and then immediately to the machine for putting on the coat of gutta-percha, so that this substance, in its warm state, softens the adhesive compound just sufficiently to form an intimate union between the surfaces.

The samples accompanying this paper having been made partly by hand, are stouter and more clumsy than they would be if finished by the proper machinery. The gutta-percha coatings might be slighter without disadvantage, consequently the weight and expense would be lessened. The qualities of this cable, then, are as follow:—

1st. The employment of the adhesive insulating compound in conjunction with the twines, lessens the liability of electrical leakage through fissures in the gutta-percha. Since the heavy hydraulic pressure to which it will be subjected in deep water will effectually preclude the possibility of fissures occurring in the adhesive bituminous compound, which will also tend to fill in or close over fissures which may be formed in the surface of the gutta-percha immediately in contact with it, thereby improving the insulation to a very great extent. 2nd. The cable will be stronger than before. Each strand of twine, in its loose state, breaks with a strain averaging 30 lbs., and when passed through the adhesive compound which binds its fibres together, and prevents them from sliding over each other, the breaking strain is increased to 40 lbs.

As these samples contain from 22 to 50 strands of twine, it is evident that the strength of the cable will be increased to the amount of 880 to 2,000 lbs. breaking strain, over and above the original strength possessed by the cable without the twine. This is a desideratum of no small importance, particularly as the twine, from its inextensible character, relieves the gutta-purcha from any strain until the twine itself is fractured.

Thirdly, the cable is light, its specific gravity varying from 1·2 to 1·49 according to the size of the conductors; hence it will not only support an immense length of itself in water, but from the additional fact of its having no tendency to twist, it can be easily drawn in again in case of accident. This lightness also requires the use of nothing but the simplest and lightest form of paying-out machinery.

Fourthly, the interposition of the porous or fibrous media breaks up the homogeneity of the dielectric, and not only reduces its specific inductive capacity, but prevents any charge which may be taken up from discharging with a degree of energy sufficient to embarrass signals.

Under ordinary circumstances, with a very long submarine cable,—such a one, for instance, as the Atlantic cable, the quantity of static charge is so considerable, and the force with which it returns into the wire so great, as to be equivalent to a current of some duration acting in prolongation of the original current, so that when reversals had to be made, it was absolutely necessary to wait until the effect of the residual charge had subsided before reversing the current, otherwise the two currents neutralized each other, and no effect was produced.

With the new cable it is presumed that this tendency to take up static charge will diminish with the diminished resistance of the wire and the increased thickness of the dielectric, and that whatever static charge may be taken up, will in its discharge be so modified in force as to be capable of interfering but very little with reversals or rapid repetitions. Supposing the worst to occur, and that the theoretical electrical advantages should not be fully realized in practice, still, electrically considered, the cable is at least as good as the best yet made; whilst in a mechanical point of view it can hardly be denied that it is superior to any.

The invention is patented by the author.

A few remarks on the Drainage of Deep Mines, with suggestions for obviating some of the difficulties of the system now in use.

By Thos. B. Jordan.

I believe I shall be stating the opinion of every mining engineer, when I say that to *lessen the probabilities* of *breakage* in the "pit-work," to *diminish the evils arising from them* when they occur, to provide a means of *repair without stopping the pump*, to lessen the *weight of pumps* and *rods*, and to avoid the use of "*balance bobs*;" without altering the quantity of water delivered by a given power, would be the greatest improvements which can reasonably be expected on the present system of drainage.

I know that it is rather unfashionable not to allow that the Cornish system of pumping is the most perfect which can be conceived, yet I shall venture to point out what I consider its defects. The greatest of these in the "pit-work," is the enormously heavy main rod and balance bobs, which are necessary in consequence of the peculiar manner in which the power is applied to the work, which frequently involves the necessity of putting 300 tons in motion by each stroke of the engine, in order to raise about 50 tons of water ten feet; and we start this great mass of matter from a state of rest into rapid motion, by the sudden impact of high pressure steam, on the top of a piston, having an area of *forty square feet*. The steam frequently has a force of 50 lbs. per square inch, so that it may fairly be said to strike a blow of about 120 tons, the effect of which is to be instantaneously transmitted through 200 fathoms of balk timber, to lift absolutely about 70 tons of unbalanced rods, and to overcome the friction and inertia of 300 tons of matter, moved through ten feet, in rather more than two seconds. The outdoor stroke of the engine is then made, and the water, of the plunger lifts, raised at the rate of about 20 feet per second, after which the whole of the machinery is at rest for some seconds, until the process is again repeated. So that it is literally true to say, that the drainage of deep mines is accomplished by a series of violent blows; and I think it a matter of surprise that the untiring energy and skill of Cornish engineers should have accomplished so much, by so difficult a process.

Nevertheless, as it is liable to great accidents, absorbs a large amount of capital, and is still difficult of application in all situations, it may be worth while to consider whether improvement is possible.

It is quite obvious that a great waste of time occurs in this process, and it appears to me that this waste of time is the source of other evils—therefore, I propose to apply the power as uniformly as possible, to avoid all rest, either in the engine or the pumps, to deliver as nearly as possible a constant stream. To get rid of all "balance bobs," and yet to have the main rod *perfectly*, instead of partially balanced, to reduce the size of pumps for a given quantity of water, by causing the stream to flow through them continuously, to reduce the weight of main rod without decreasing its strength with reference to its work, and to support the rod in the shaft independently of its connection with the engine.

In order to carry out these ideas, I propose to use double acting engines, (either condensing or non-condensing, according to the requirements of the case,) with two cylinders driving cranks on the same shaft, set at right angles to each other. A pinion or pinions on this shaft would drive a wheel on the pumping shaft, which would be fitted with cranks having a radius of half the length of the pump stroke, these would be set on the same line of diameter on opposite sides of the centre, and would give motion to the main rods, either directly or through the medium of horizontal rods and quadrants. In this way uniformity of motion may be ensured, provided the main rod is perfectly balanced, and the resistances made tolerably uniform throughout an entire stroke, and as this form of engine admits of the use of a fly-wheel, and will make several strokes to one of the pumps, there can be no difficulty in keeping the rate free from any injurious irregularities; while the rate of pumping from time to time will be as perfectly under control of the engine man as it is at present.

I propose in all cases to use high pressure steam, and to take all the advantage of the expansive principle which the Cornish engineers have shown it to be capable of affording.

The question of using condensing or non-condensing engines, is one which admits of much difference of opinion; my own view is, that all works of adventure, can be conducted *better*, *quicker*, *and cheaper*, with non-condensing engines.

That the advantage is always with non-condensing engines, in coal districts, and that it only rests with condensing engines, when extensive and permanent works have to be conducted where coal is very dear. Cornwall is the only county in the British Islands, where extensive mining operations have to be worked with dear coal, and it is the birth place of single acting condensing steam engines, yet if all the works of adventure which have been tried there during the last twenty years had been worked with non-condensing plant, I believe a very large sum of money would have been saved to the adventurers. Nevertheless when *permanent* works have to be conducted under this combination of circumstances, I admit it may be advantageous to condense the steam, and to carry the expansion to its greatest extent by the use of double cylinders, but I would still have continuous action, and use the power of the steam in both directions, for by doing this, I reduce the weight and cost of the entire plant from the engine to the "sump," and although I am fully alive to the advantage of a small working cost, I cannot admit that this is accomplished when the interest on additional outlay, far exceeds any probable saving in coal, which can be effected by it.

It is not yet proved beyond question, that any very great saving of fuel can be attained by condensing the steam, although it is a generally received opinion, and I think so far as the *examples in use show*, it must be admitted as a fact that condensing engines use less coal, to produce a given effect, than non-condensing engines; but when we remember how entirely the former class of engine has engrossed all the attention of engineers, and how completely the more simple mode of gaining power has been neglected, we must, I think, confess that we have yet to learn what may be done with non-condensing engines, if their capabilities were equally cultivated.

Having discussed the propriety of using an engine of continuous motion, and the method of applying its power to the rods, I have next to suggest a mode of arranging the pit-work, which appears to me capable of securing many advantages, and remedying the defects I have already alluded to—viz., the great weight of main rod; the necessity for large balance bobs; for leaving a portion of the weight of main rods unbalanced; and the great area of pumps requisite for a given quantity of water. The continuous application of power to the work, enables me to remove or materially lessen each of these defects. The main rod need not be so heavy, because it is used as a tension rod, and it is not put in motion by a blow, but is brought gradually to the end of its stroke in each change of direction. I propose to make it of wrought iron, by combinating two flat bars of iron, kept asunder by a strip of timber; these would be secured end to end by inside coupling pieces, so that in every part of the rod there will be a section of iron, more than sufficient to bear every strain it can be subject to, as its working load, the timber merely being employed as a distance piece, which may be removed whenever its space is required for the suspending chains and couplings, to be described; I use two of these rods to avoid the necessity for balance bobs, and I suspend them in the shaft by chains passing from one to the other over properly fixed pulleys in different parts of the shaft, which chains would pass down between the two plates of the rods and be attached to them by keys or tightening screws in such a way as to admit of perfect freedom of motion for the length of the stroke, and at the same time to secure the exact balance of every section of the rod by the similar section of opposite rod. In this way, my main rod would be so perfectly balanced and suspended in the shaft, that it would, without attachment to the pumps or engine, remain indifferently in any part of its stroke; while, by the same means, all balance bobs and spaces in the shaft to receive them, are entirely done away with. The breakage of a main rod so arranged is almost an impossibility; and if it could be broken, no great mischief could arise, for it is supported at intervals throughout its entire length, and its total weight would be less than one-fourth of the *unbalanced* weight of ordinary main rods suited to similar circumstances. It will probably be said that, by reducing the weight of rod so much, I give up the power requisite for lifting the water of the plungers, and so far as this weight is concerned, this is true; but I prefer leaving this duty to the direct power of the engine, because I hold that when we have certain work to do with the power of engines or animals, the most direct way of applying that power is the best. Therefore, instead of making the engine pull up a weight in order that the weight, in its descent, may push up another weight, I make the engine pull or push up the water by its direct action, and I do this without depending on the stiffness of the rods to sustain the load of water, (which may be objectionable) by passing one or two strong chains underneath properly fixed pulleys and attaching them to the rods in the reverse order of the suspension chains, thus connecting the rods with each other in both directions.

In carrying out this system, I propose using two working barrels or two plunger poles where one is now used; each of these would be of half the area of those now used for a given quantity of water, and the two plungers would discharge their water into the same column of pumps, which being only half the usual area may be cast thinner without any reduction of strength, so that the entire weight of pumps in the shaft would not be more than two-thirds of those now used. The cost of plant would be much reduced, and the working advantages of a smaller pump would be secured without altering the quantity of water delivered in a given time, or in any way changing the working details of the pumps themselves. Neither would it require more power, because, as the mass put in motion by each stroke of the engine is much less, and the load lifted from a given depth in a given time is the same, there is no source from which increased resistances can arise. But, on the other hand, I may fairly contend that the reduction of mass and the constant motion, lessens the vis-inertiæ to be overcome, and that the uniform action of balanced machinery is always attended with less vibration and less extraneous resistance of every kind, than the intermittent action of unbalanced machinery, and, therefore, less power will be required. But the success of the proposal does not depend on its requiring less power to accomplish the same work, although much may be said on this point, for, if I require the same power, I still have the advantage of doing it with smaller pumps and lighter rods, not requiring balance bobs, yet perfectly balanced; and these working advantages are obtained by machinery of far less cost than that now employed, and which is not so liable to delays, because the most fruitful sources of accident are left out. Certainly I have two clacks and buckets and two plunger poles, instead of one, but they are much smaller than the one must be to do the same work, and besides the advantages already enumerated, they give the means of repair without stopping the process of draining the mine; for, with the arrangement described, there can be no difficulty in disconnecting the particular working barrel requiring repair and refitting its bucket, or even putting in a new working barrel without stopping any other part of the work. Those acquainted with the work, will readily admit that the power of raising even one-half of the water made during the progress of repairs of this kind, would in some cases be of immense importance, and may be the means of saving a column of pumps and the stoppage of extensive workings.

But even in the ordinary change of buckets in a drawing lift, the advantage would be great, because it could be always done through the bucket door, whereas when only one working barrel is used in a heavily watered mine, this, for the most part, is too dangerous an experiment to attempt; and the plan generally adopted, is to draw both rod and bucket out of the pumps, simply to repair the leather.

In order still further to simplify these repairs and alter the construction of the valves—not by any ingeniously contrived complication of metallic valves, because the occasion for these is done away with by the reduction in the area of pumps, but by making the valve a simple disc of leather or India rubber, with a hole in its centre; and the valve seat a perforated casting of sufficient strength, having a "spill" projecting from its centre, upon which the leather disc rises, against a guard fixed over it. This arrangement is very durable, and affords abundant water way; it falls freely on its seat, is not affected by sand or small gravel, and can be renewed in a few minutes.

TABLE No. 1.

Meteorological Summary of the Weather at Helston, in Lat. 50° 7′ N., Long. 5° 18′ W., for the year 1859, from Registers kept by M. P. Moyle, Esq.

1859.	MONTHLY MEANS OF THE BAROMETER. Cistern 106 feet above mean sea level.																		
Month.	Mean pressure corrected to 32° Fahr. 9 a.m.	3 p.m.	9 p.m.	Mean of monthly means.	Mean correction for diurnal range.	True mean of monthly means.	Mean force of vapour.	Mean pressure of dry air.	Mean range of means.	Mean daily range.	Corrected absolute maximum observed.	Day.	Corrected absolute minimum observed.	Day.	Extreme range for the month.	Greatest range from 9 a.m. to 9 p.m.	Day.	Greatest range in any two consecutive 24 hours.	Between which days it occured.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.		in.		in.	in.		in.	
Jan.	30.178	30.158	30.171	30.169	.004	30.165	.292	29.873	.132	.079	30.800	10	29.380	23	1.420	.250	25	—.584	22 & 23
Feb.	29.951	29.945	29.947	29.949	3	29.946	.298	29.647	.164	.095	30.611	23	29.189	9	1.422	.352	4	—.568	3 & 4
March ..	30.014	29.992	29.996	30.001	7	29.994	.316	29.678	.234	.130	30.479	6	29.191	29	1.288	.486	11	+.778	14 & 15
April....	29.728	29.710	29.710	29.716	4	29.712	.316	29.396	.127	.118	30.165	3	29.164	14	1.001	.492	12	+.529	14 & 15
May	29.883	29.886	29.889	29.886	2	29.884	.357	29.527	.072	.039	30.194	11	29.601	29	.593	.118	5	+·269	7 & 8
June	29.887	29.886	29.896	29.891	1	29.890	.423	29.467	.097	.067	30.178	18	29.467	2	.711	.179	6	+.347	26 & 27
July	30.047	30.048	30.046	30.047	2	30.045	.523	29.522	.068	.047	30.296	6	29.688	31	.608	.164	30	—.328	17 & 18
August ..	29.924	29.920	29.929	29.925	4	29.921	.501	29.420	.102	.065	30.265	22	29.660	7	.605	.137	23	—.296	23 & 24
Sept.	29.825	29.829	29.823	29.826	4	29.822	.421	29.401	.127	.107	30.348	11	29.330	15	1.018	.276	12	—.460	11 & 12
October..	29.595	29.572	29.585	29.586	6	29.580	.389	29.191	.166	.113	30.099	2	28.836	25	1.263	.380	25	—.559	24 & 25
Nov.	29.887	29.859	29.875	29.872	4	29.868	.321	29.547	.173	.122	30.537	10	28.978	4	1.559	.512	1	+.843	1 & 2
Dec.	29 714	29.695	29.706	29.708	3	29.705	.263	29.442	.174	.117	30.556	10	28.365	25	2.191	.522	26	+.869	25 & 26
Means ..	29.886	29.874	29.881	29.881	4	29.877	.368	29.509	.136	.099	30.377		29.237		1.139	.322		.536	

REMARKS.—0.121 in. should be added to all the readings of the Barometer for its elevation of 106 feet above mean sea level. The Barometer is a standard, having a bore of 0.6 in. in diameter, with glass cistern 3 in. in diameter, whereby the ivory point of the brass scale can, by sight, be brought to a tangent with the surface of the mercury at each observation; the open end of the tube has a ring of platina, as recommended by Daniell, for the perfect exclusion of atmospheric air—the tube was filled in vacuo with mercury of the specific gravity of 13.5—and Mr. Glaisher's corrections have been applied to every period of observation, as taken from the Philosophical Transactions, part 1, for 1848.

TABLE No. 2.

MONTHLY MEANS OF THE THERMOMETERS.

1859. Mo.	DRY AND WET BULB THERMOMETERS. 9 a.m. Dry.	9 a.m. Wet.	3 p.m. Dry.	3 p.m. Wet.	9 p.m. Dry.	9 p.m. Wet.	Mean of dry Therm.	Correction for diurnal range.	True mean of dry Therm.	Mean of wet Therm.	Correction for diurnal range.	True mn. tem. of evaporation.	Wet Therm. below dry.	Mean temp. of Dew point.	Dew pt. below dry Therm.	Greatest range of dry Therm. from 9 a.m. to 9 p.m.	REGISTERING THERMOMETERS. Mean of all the maxima.	Mean of all the minima.	Approximate mean temp.	Correction for the month.	True mean temperature.	Mean range.	Maximum observed.	Day.	Minimum observed.	Day.	Mean.	Range.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°		°		°	°
Jan.	46.6	44.1	48.9	46.4	45.9	44.4	47.1	0.4	46.7	45.2	.4	44.8	1.9	42.9	3.8	9.0	51.3	41.6	46.4	0.2	46.2	9.7	55.0	21	31.0	9	43.0	24.0
Feb.	47.8	45.3	50.6	47.6	46.8	45.1	48.2	.6	47.6	46.0	.4	45.6	2.0	43.4	2.2	10.0	53.5	41.5	47.6	.4	47.2	12.0	58.0	16	32.0	23	45.0	26.0
Mar.	49.4	47.1	51.7	48.5	48.1	46.3	49.7	1.2	48.5	47.3	.7	46.6	1.9	45.1	3.4	10.0	54.7	44.2	49.4	1.0	48.4	10.5	61.0	6	32.0	31	46.5	29.0
April	51.3	48.5	54.3	50.3	48.4	47.3	51.3	2.2	49.1	48.6	1.4	47.2	1.9	45.1	4.0	13.0	57.4	43.9	50.6	1.5	49.1	13.7	73.0	6	32.0	17	52.5	41.0
May.	58.5	54.0	60.7	55.6	53.8	51.5	57.7	2.3	55.4	53.8	2.1	51.7	3.7	48.7	6.7	14.0	63.5	49.8	56.8	1.7	55.1	14.0	72.0	24 & 26	39.0	7	55.5	33.0
June	64.1	59.1	67.1	60.2	60.6	57.5	63.9	3.0	60.9	58.9	2.0	56.9	4.0	53.7	7.2	11.0	71.5	56.4	63.9	1.8	62.1	15.1	79.0	13	48.0	11	63.5	31.0
July.	70.2	65.0	73.9	66.3	66.1	62.5	70.2	2.2	68.0	64.6	1.3	63.3	4.7	60.0	8.0	13.0	80.6	59.5	70.0	1.9	68.1	21.1	90.0	1 & 11	52.0	22	71.0	38.0
Aug.	67.0	62.9	69.4	64.5	63.6	60.8	66.7	2.1	64.6	62.7	1.4	61.3	3.3	58.7	5.9	11.0	74.4	58.0	66.2	1.7	64.5	16.4	87.0	20	51.0	30	68.0	36.0
Sept.	60.7	57.3	63.4	58.5	58.5	55.9	60.8	1.7	59.1	57.2	1.2	56.0	3.1	53.5	5.6	11.0	66.5	53.2	59.8	1.3	58.5	13.4	72.0	11	44.0	26	58.0	28.0
Oct.	55.8	53.6	58.9	55.7	54.7	54.7	56.5	.8	55.7	53.9	.7	53.2	2.5	51.2	4.5	10.0	62.0	48.8	55.4	1.0	54.4	13.1	73.0	3	32.0	23	52.5	21.0
Nov.	50.4	48.0	52.9	50.1	49.3	47.5	50.9	.5	50.4	48.5	.5	48.0	2.4	45.6	4.8	11.0	55.9	45.4	50.6	.4	50.2	10.5	62.0	4	34.0	10	48.0	28.0
Dec.	44.2	42.3	45.7	43.7	43.4	42.0	44.4	.2	44.2	42.5	.2	42.3	1.9	39.8	4.4	11.0	49.2	38.9	44.0	.0	44.0	10.3	57.0	9	22.0	18	39.5	35.0
Mns.	55.5	52.3	58.1	53.9	53.3	51.3	55.6	1.4	54.2	52.4	1.0	51.4	2.8	48.9	5.0	11.0	61.7	48.4	55.0	1.1	53.9	13.3	69.9		37.4		53.9	33.0

REMARKS.—The Registering Thermometers are on Rutherford's principle and perfectly accurate. The Dry and Wet bulb Thermometers were made by myself with every care, and are found to be coincident, very nearly, with a standard Thermometer; where there has been any discrepancy the difference has been correctly noticed and allowed for.

TABLE No. 3.

1859.	WINDS.																															
MONTH.	N.			N.E.			E.			S.E.			S.			S.W.			W.			N.W.			AVERAGE FORCE.				RELATIVE PROPORTION.			
	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 a.m.	9 p.m.	Mean.	N.	E.	S.	W.
Jan	5	3	3	3	2	1	2	3	3	2	2	3	2	3	3	5	6	4	9	10	10	3	2	4	1·6	2·1	1·8	1·8	18	15	18	42
Feb	2	1	1	0	0	0	1	1	0	1	0	1	1	2	2	9	12	11	7	7	7	7	5	6	2·0	2·3	1·6	1·9	13	8	22	46
March..	4	5	4	0	0	0	0	0	0	1	0	0	1	3	2	10	11	10	7	4	5	8	8	10	2·3	2·3	1·7	2·1	26	0	22	45
April...	3	3	5	1	0	2	8	8	4	0	1	1	4	2	1	7	11	11	4	1	1	3	4	5	2·3	2·2	1·5	2·0	19	22	22	27
May....	4	4	6	3	4	5	12	11	7	1	1	1	1	1	1	1	5	3	0	2	2	4	3	6	2·0	2·0	1·0	1·6	29	39	9	16
June....	2	4	4	3	2	4	4	4	2	5	2	1	3	2	4	4	5	4	2	4	7	7	7	4	1·9	2·1	1·5	1·8	23	19	19	29
July....	3	3	5	0	0	0	6	4	3	2	0	0	5	4	2	9	12	8	1	4	4	5	4	9	1·7	2·3	1·1	1·6	20	14	26	33
August..	2	1	1	0	1	2	6	4	3	0	0	1	5	3	2	12	13	11	3	5	5	3	4	6	1·9	2·1	0·8	1 6	12	16	28	37
Sept....	2	4	4	1	0	0	1	0	0	1	1	0	1	3	4	10	11	10	7	5	7	7	6	5	2·0	2·4	1·7	1·9	19	3	24	44
Oct.....	3	1	1	2	0	1	5	6	8	4	4	2	4	2	4	6	9	5	3	5	6	4	4	4	1.9	2·2	1·5	1·8	12	26	25	30
Nov....	3	3	2	3	3	1	5	4	5	5	7	6	0	2	2	9	8	6	4	4	5	2	1	2	1·9	2·3	1·5	2·0	13	27	25	25
Dec.....	4	3	3	6	5	6	7	4	3	1	3	3	0	2	1	9	7	6	4	4	7	0	3	2	2·1	2·1	1·6	1·9	21	26	18	28
Sums...	37	35	39	27	17	22	57	49	38	23	21	19	27	29	28	91	110	89	51	55	63	53	51	63	236	264	173	220	225	210	260	408
Means..		37·0			22·0			48·0			21·0			28·0			97.0			57·0			55·0		1·9	2·2	1·5	1·9	19	17	22	34

TABLE No. 4.

1859. Month.	Average Cloudiness. 9 a.m.	8 p.m.	9 p.m.	Means.	No. of dry days.	No. of wet days.	No. of days observed.	Amount of rain in cubic inches.	Mean weight of vapour in a cubic foot of air.	Mn. addl. weight required for saturation of the air.	Mean force of vapour.	Mean degree of humidity saturation = 1·000.	Mean weight of a cubic foot of air at its respective pressure.	Mean degree of dryness of the atmosphere.	Mn. amt. of water in a vertl. col. of the atmosphere.	Moffat's Oxonometer. 9 a.m.	9 p.m.	Means.	Days in which more than a quarter of an inch fell.	REMARKS.
								in.	grs.	grs.	in.	in.	grs.	o	grs.					
Jan. ..	6.7	7.1	6.9	6.9	12	19	31	3.51	3.37	0.47	0.292	0.879	547.35	3.8	4.04	2.5	1.7	2.1	8, 14, 17, 21, 22, 23, 28, 29.	Fog 1; hail 19, 26, & 30; lightg. 30.
Feb. ..	5.4	5.5	5.5	5.5	14	14	28	2.56	3.43	.53	.298	.864	542.28	2.2	4.12	3.0	1.6	2.3	3, 5, 8.	Honeysuckle in leaf 8; lilac 15; peach in bloom 12; hazel do. 12.
March.	6.5	6.5	7.0	6.5	15	16	31	3.22	3.64	.43	.310	.893	542.10	3.4	4.37	3.6	2.3	2.9	11, 13, 17, 20, 28, 29.	Fog 4; hail & snow 30; thund. & lightg. 30; elm in leaf 1; lomb. poplar: hawthorn 15; horse chestnut 28; rooks build 25; lunar halo 16.
April ..	6.1	6.1	5.3	5.7	13	17	30	3.67	3.62	.53	.319	.872	536.46	4.0	4.37	2.4	1.5	1.9	8, 12, 14, 22, 27, 28, 30.	Apple in bloom 5; lilac 10: cuckoo 11; hail 15, 16; first swallow 18; Aurora Borealis 21.
May ..	4.0	5.1	3.8	4.3	20	11	31	1.48	4.05	.93	.357	.796	532.14	6.7	4.94	1 3	1.1	1.2	4, 9.	Lightg. 20; fog 28; thund. 21; laburnum in bloom 14.
June..	5.8	4.8	3.8	4.7	20	10	30	.92	4.74	1.30	.423	.784	514.86	7.2	5.85	0.8	1.2	1.0	24:	Honeysuckle in bloom 3; fog 7; lightg. 8; wheat in ear 9, in bloom 13; thund. storm 25; barley and oats in ear 25.
July ..	4.5	3.2	4.2	3.9	23	8	31	1.06	5.78	1.75	.523	7.67	521.23	8.0	7.23	1.1	1.3	1.2	2.	Oats cut 22; barley do. 23; wheat do. 24.
Aug...	4.8	4.2	3.8	4.2	19	12	31	3.29	5.58	1.20	.501	.821	522.65	5.9	6.93	1.4	1.0	1.2	3, 5, 6, 7.	Thund. 3; peaches 7; Jargonelle pear 8.
Sept...	5.9	5.8	5.9	5.9	12	18	30	4.37	4.73	.98	.421	.828	527.05	5.6	5.82	2.1	1.4	1.7	8, 12, 15, 18, 20, 22, 24, 29.	Lunar halo 14; fog 24; meteors 25, 28.
Oct. ..	5.9	6.4	5.8	6.0	9	22	31	4.70	4.41	.72	.389	.859	526.50	4.5	5.38	1.0	.9	0.9	18, 24, 25, 31.	Fog 1, 9; teal 8; woodcock 11; last swallow 19; Aurora Borealis 12; hail 21, 28; thun. 21, 25, 31; lightg. 23, 24, 31; hawthorn leafless 22; shook earthquake 25.
Nov...	6.5	6.5	6.2	6.4	16	14	30	3.89	3.38	.96	.321	.778	538.19	4.8	4.44	1.6	1.2	1.4	2, 3, 24, 26, 29.	Thund. storm 1; fog 22; first fieldfare 24.
Dec. ..	6.9	6.5	6.6	6.6	9	22	31	4.75	3.04	.50	.263	.859	541.92	4.4	3.64	1.3	1.0	1.2	4, 16, 19, 20, 23, 25, 30.	Hail 1, 28; snow 14, 15, 16, 17, 19; thunder 27; lightning 27, 28.
Means.	5.8	5.6	5.4	5.6	182	183	365	37.42	4.15	.86	.368	.883	532.81	5.0	5.09	1.8	1.3	1.6		

REMARKS.—The Rain Guage is on Howard's principle, 5 feet from the surface of the ground, and perfectly free from any local effects. Wet days include fog and snow. The dew point, weight of vapour in a cubic foot of air, humidity, &c., are deduced from the tables in the Greenwich Meteorological Observations for 1847. The corrections for the diurnal ranges of the barometer and thermometers are from Glaisher's tables: and in all the calculations, and adjustments of the instruments, a strict adherence has been given to the directions of the Astronomer Royal and the Committee of Physics of the Royal Society.

Meteorological Register for Bodmin, 1859.

BY LIEUT. LIDDELL, R.N.

Lat. 50° 29' N., Long. 4° 40' W. Height above the sea 300 feet. Rain Guage above the ground 3 feet.

Month.	Max: of Bar.	Min: of Bar.	Max. of Ther.	Min. of Ther.	Average Ther.	Rainy Days:	Greatest fall in one day.	Monthly fall of Rain.	Average of rain fell.	Average of rainy days.	Remarks.
	ins.	ins.	deg.	deg.	deg.		inches.	inches.	inches:		
Jan.	31·01	29·00	62	25	42	20	23rd 0·98	3·79	5·14	23	
Feb.	30·78	28·85	58	31	43	19	9th 0·73	2.61	2·51	16	
Mar.	30·50	28·85	58	29	46	20	11th 0·68	3·65	3·30	15	
April	30·15	29·04	70	26	48	18	15th 0·51	3·33	3·31	15	
May	30·13	29·44	67	36	55	9	10th 0·63	1·78	2·90	15	
June	30·07	29·44	71	47½	59½	12	20th 0·21	0·89	3·00	15	
July	30·33	29·56	75	52½	65½	12	2nd 2·33	4·13	3·10	16½	2 10 inches fell in 1½ hours.
Aug.	30·31	29·52	76	51	63	17	3rd 0·90	3·90	2·90	16	
Sept.	30·38	29·23	67	46½	56½	23	14th 1·01	5·69	2·94	13½	
Oct.	30·05	28·28	69	33½	53½	23	1st 0·60	5·88	5·35	21	
Nov.	30·72	28·52	58	32	46	19	4th 0·94	4·26	4·51	20	The lowest reading of Bar. ever recorded here by 0·25.
Dec.	30·68	27·85	54	15	39	24	25th 0·75	4·99	4·52	21½	
					51	216	Rain fall in 12 days. 10·27	44·90	43·48	207	

Total fall of rain in Bodmin in 1859, 44·90 inches.

Days with rain, 216.

Average number of rainy days, 207.

Greatest fall in one day, July 2, 2·33 inches.

Average fall of rain in Bodmin, 43·48 inches.

Fall per diem in 1859, 0.1203.

Extremes since 1849 { Greatest fall in 1852, 59·64 inches. Least fall in 1859, 33·15 inches.

Average temperature of Bodmin in 1859, 51 degrees.

Lyons, field W. of Lyons & Geneva rly. stn.. v	63.57	
▲	63.49	63.53
Geneva, court yard of Hotel des Bergues.. v	63.59	
▲	63.47	63.53
Lucerne, garden of Hotel Schweizerhof .. v	64.10	
▲	64.6	64.8
Garden of Hotel Weber, Falls of Rhine v	64.33	
▲	64.33	64.33
Heidelberg, under Castle wall v	65.52	
▲	65.54	65.53
Bonn, on Der alte Zoll v	67.11	
▲	67.7	67.9

* Index error of *Intensity Needle* + 6', which correction has been made in the results given of the dip.

It will be seen that sometimes one pole of the *reversing needle* preponderated, and sometimes the other, attempts having been made from time to time during the journey to correct the balance by grinding.

The mean of the angles of deflection at London was 44° 38', and calling this 1.0000, it was found that between this angle and the angle obtained at Pœstum (46° 13') every *minute* of deflection, when the deflectors were employed, was equal to .00088.

The correction required for temperature was ascertained to be—

With the deflectors........................ .00005 for 1°, Fahrt.
And the needle with the weights alone.... .00003 ditto.

These corrections being in *opposite* directions for changes of temperature.

Changes in the magnetic force of the needle, or deflector, or of both, would also affect the results of intensity indicated by them in *opposite directions*; but it will be seen by the table, that the results fairly agree throughout the series, showing that there had been no material loss of magnetic force.

The intensity near Falmouth in 1837, was rather *more* than in the vicinity of London, and now it appears to be rather *less*;—indicating that the *isodynamic* lines have become *less inclined* to the parallels of latitude than they then were. General Sabine also has observed this change, and he considers that the *isoclinal* lines are likewise *less inclined* than they were in 1837.

Results of Experiments on the Magnetic Dip and Intensity in some parts of Europe in the Spring of 1859.

Lyons, field W. of Lyons & Geneva rly. stn. . v	63.57	
A	63.49	63.53
Geneva, court yard of Hotel des Bergues. . v	63.59	
A	63.47	63.53
Lucerne, garden of Hotel Schweizerhof . . v	64.10	
A	64.6	64.8
Garden of Hotel Weber, Falls of Rhine v	64.33	
A	64.33	64.33
Heidelberg, under Castle wall v	65.52	
A	65.54	65.53
Bonn, on Der alte Zoll v	67.11	
A	67.7	67.9

* Index error of *Intensity Needle* + 6', which correction has been made in the results given of the dip.

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ROYAL CORNWALL POLYTECHNIC SOCIETY

FOR THE ENCOURAGEMENT OF

Science and the Fine and Industrial Arts.

INSTITUTED 1833.

LIST OF PREMIUMS AND PRIZES

FOR 1860.

PREMIUMS.

NOTICE.—The Society, in all cases, reserves the power of rewarding each communication in proportion to its merit, or even of withholding the Premium altogether.

Competition not confined to members, or residents in Cornwall.

1. MINE VENTILATION.—The following sums have been subscribed for promoting Improved Ventilation in the Cornish Mines:—

Royal Cornwall Polytechnic Society	£50
Hon. Mrs. Agar	10
John J. Rogers, Esq..............................	10
United Mines Adventurers......................	10
T. J. A. Robartes, Esq., M.P..................	5
Rev. H. Molesworth St. Aubyn	5
Augustus Smith, Esq., M.P.	5
C. F. Giesler, Esq.	5

It has been determined that the amount shall be divided into four premiums as specified below :—

Two premiums, one of £50 and another of £25 (to be further augmented in the same ratio as donations to the funds shall allow), to be given to the agents of the first and second best of the two mines in which, under the circumstances of the case, the ventilation shall be most complete; regard being particularly had to "close ends," and the extent to which effective ventilation is carried from the main natural draughts. The effectiveness of the ventilation, both with respect to the quantity and quality of the air supplied, to be tested in such manner as the adjudicators of the premiums may deem satisfactory. The premiums must be applied for, at least two months before the annual exhibition of the society, and if awarded are to be paid to the adventurers of the mines for distribution by them amongst their agents.

A premium of £10 for the best model, and a premium of £5 for the best plan, for increasing the ventilation of mines, especially in those parts which are difficult to reach by natural ventilation.

The Polytechnic Society offers the above premiums for competition, in the hope of directing attention to the importance of improving the ventilation of the Cornish mines. Tables exhibiting the comparative early decease of Cornish miners, and Papers connected with this subject, have been printed in several of the society's annual Reports, and they shew that working in deep mines is frequently attended with the sacrifice of health and the abridgment of life. The evil appears to arise from the miners often working in a stagnant atmosphere, impregnated with deleterious gases and deficient in oxygen, which is so essential to the preservation of life. Attention should be drawn to the subject, whether the draughts obtained in mines by winzes at a distance from the shaft are in many cases local only, and consisting of circuits of vitiated air.

The larger portion of this fund will be distributed with the view to encourage practical ventilation rather than the discovery of new methods of effecting it, as it is believed that the latter are not so much required as the judicious direction and use of the natural draughts; and, where these are insufficient, the introduction of such mechanical aids as have been already found effective. The machines at present employed are—first, the reciprocating pump, in various forms, for forcing or extracting air; second, fans, rotating at high velocities; third, rotatory air pumps, constructed somewhat on the principle of the rotatory steam engines. The last have been successfully applied in France and Belgium, although they appear to be little known in Cornwall. As these machines require only a slow motion, and give a continuous current of air without changing its direction, they seem well adapted for the ventilation of our mines in those cases where machinery is requisite.

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2. DRESSING ORES.—A premium of £20, by the Editor of the *Mining Journal*, and by the society (or such portion thereof as the judges shall consider suitable), to the originator of improvements in the dressing of ore; such improvements to have been in successful operation for a period of not less than six months.

3. IMPROVEMENT IN MINING.—A premium of £5, by the late Editor of the *Mining Journal*, for the best Paper containing an account of any methods, or plans, practised in any other mining districts, advantageously applicable to the Cornish mines. To be accompanied by the necessary drawings.

Note.—The introduction of improved methods of drawing the ores and rubbish from the Cornish mines appears to the committee to be worthy of attention with reference to this premium.

4. DRIVING LEVELS.—Premiums of £7 7s., £5 5s., and £2 2s., by Charles Fox, Esq., for the best Reports of comparative experiments or trials, made under the eyes of the competitors since Sept., 1855, of the relative expense of driving levels in granite or killas, "working big," and of ordinary height; and of driving others of not less than 6 feet in width, and of proportionate

height. The ground should not be of less hardness than £6 per fathom. The tramming may be reduced to 20 fathoms and the hauling to surface at 80 fathoms, as a standard, the landing to be included in the cost. Experiments in carrying an end 8 feet wide would be more satisfactory than driving one only 6 feet wide, as the advantages or disadvantages of an end 8 feet wide would be more manifest than when it was only 6 feet. Time being as important an element as money in the cost of mining operations, it is desirable that the time spent in driving "wide" and "narrow" levels in rocks of nearly equal hardness should also be stated.

Note.—An end which has a "hulk" or "let go" in some part of it, does not admit of a fair comparison.

5. MINERAL VEINS.—A premium of £5 by the society, and £3 by Sir C. Lemon, Bart., for the most exact account of the phenomena of mineral veins in any mine or district, their dip, direction, variations in productiveness, slides, heaves, &c. The Society being especially desirous of cultivating close habits of observation in our miners, will give prizes for accurately drawn cross sections; for collections of *ores* and *country* in which the relations of one to the other are carefully marked; for drawings and descriptions of any remarkable phenomena observed in lodes, &c.

6. CONSUMPTION OF COAL, &c.—A premium of £5 5s., by John Taylor, Esq., F.R.S., for the most complete and accurate accounts of the quantity of water supplied to the boilers, the number of bushels of coals consumed, and the duty performed by an engine, for a period of not less than six months.

7. WORKING PLAN OF A MINE.—A premium of £3 3s. by the society, for the best working plan of a mine in full work (sections of the lodes not required). The plan to be corrected to some time within three months previous to its exhibition. To be drawn by the person who dialled the mine-workings, not being a professional dialler, of which satisfactory evidence must be adduced.

PRIZES.

AT THE NEXT ANNUAL EXHIBITION, PRIZES WILL BE AWARDED TO MERITORIOUS PRODUCTIONS IN ANY OF THE FOLLOWING DEPARTMENTS:—

MECHANICAL DEPARTMENT.

NATURAL PHILOSOPHY.—CHEMICAL ANALYSIS.—
MECHANICAL AND OTHER SCIENTIFIC INVENTIONS AND IMPROVEMENTS.—
MODELS OF MACHINERY, NOT DISPLAYING INVENTION.—
NAVAL ARCHITECTURE.

Inventions and improvements should be accompanied by accurate models or drawings, and explicit descriptions. The drawings should be on a scale large enough to admit of their being seen when hung against the walls of the room; and all descriptions or communications should be written on foolscap paper, on one side only, leaving 1¼ inch margin.

The Society being wishful to encourage excellence of workmanship in the handicraft trades and tools, will place at the disposal of the judges a certain number of prizes to be awarded to apprentices and artizans.

Note.—The society will empower the judges to award a reasonable remuneration for the time and labour devoted by *working men* to the production of any deserving models or machines which may be exhibited by them.

FINE ARTS.

SCULPTURE AND MODELLING.—OIL PAINTING.—WATER COLOURS.—PENCIL, CRAYONS, ETC.—ENGRAVING AND ETCHING.—LITHOGRAPHY.—ARCHITECTURE.—ORIGINAL DESIGNS ADAPTED FOR MANUFACTURES IN SERPENTINE, GRANITE, PORPHYRY, ETC.

Competition in this department is restricted to Amateurs.—For regulations respecting the productions of Professional Artists, see page 8.

Premiums of £1 each are offered for the following subjects:—

1. For the best filled sketch-book from Nature.
2. For the best series of six flowers from Nature, in chalk or pencil.
3. For the best series of six sketches, in water colours, of different rocks, shewing their jointed structure and characteristics.
4. For the best water-colour drawing of any simple object from nature the natural size.
5. For six outlines of stems and branches of British Trees, on imperial-size paper, giving carefully the forms of leaves and anatomical characteristics of stems.
6. For the best series of original sketches of our Cornish Antiquities,—Celtic, Roman, or Saxon.
7. For the best series of six outlines of the human hand or foot, life size, from the cast, or from life; indicating light and shade by the lightness or strength of the outline.
8. For the best shaded crayon drawing of one of the busts in the Polytechnic Hall, full size, or the bust of any well-known character.
9. For the best engraving on wood, or lithograph.
10. For the best series of not less than 12 photographs.

SCHOOL PRODUCTIONS.

PRIZES FOR SCHOOLS, OR YOUTHS UNDER 16 YEARS.

A prize of £1, for the best series of six perspective outlines, with original illustrations.
Prizes of £1, 10s., and 7s. 6d., for the best mechanical drawings.
Prizes of £1, 10s., and 7s. 6d., for the best series of drawings from objects or models.
Prizes of 10s., 7s. 6d., and 5s., for the best water-colour drawings, original.
Prizes of 10s., 7s. 6d., and 5s., for the best pencil or crayon drawings.
Prizes of 10s., 7s. 6d., and 5s., for the best maps.
Prizes of 10s., 7s. 6d., and 5s., for the best specimen of penmanship.

Note.—Plain writing and printing on a sheet of foolscap, will better meet the views of the committee, than the more decorative styles which have been hitherto sent for exhibition.

Prizes of 10s., 7s. 6d., and 5s., for the best series of drawings from objects or models, by boys belonging to National and British Schools.

The conductors of schools in this county are invited to encourage their pupils to compete for the foregoing prizes (also for the premiums for persons under 18 years), and to prepare other productions for the exhibition, as suitable prizes will be awarded to the most deserving.

Note.—It is required that with respect to the productions of persons under 18 years it may be stated, that each drawing or map is the unassisted work of the exhibitor.

NATURAL HISTORY.

ESSAYS.—LOCAL OBSERVATIONS.—COLLECTIONS OF SPECIMENS, PARTICULARLY SUCH AS ILLUSTRATE THE NATURAL HISTORY OF THE COUNTY.

Specimens sent for competition should be properly arranged and accurately named.
Prizes will be especially given for Monographs of any particular family or large genus indigenous to the county, either in Botany or Zoology, such as the *Gramineæ* or the *Hieraceæ* ; the *Holothuriadæ* or the *Medusæ* ; the *Palmipedes* ; the *Rodentia*, &c., &c.

A premium of £2 2s. for the best Illustrated Journal of Natural History, by persons under 20, on the plan of Mr. Cocks' Medley.

A premium of £3, by Mrs. Barclay Fox, for the best Calendar of Nature, presenting in a tabular form the comparative view of the dryness or moisture of different years ; exhibiting also the advance of the seasons by the time at which various trees, plants, &c., burst into leaf or flower, taking, of course, the same tree each year. The candidates to be under 18 years of age.

STATISTICS.

Communications in this department should relate to subjects connected with the county of Cornwall.

Lander Prizes, for Competitors under 18 Years of Age.

Charles Fox, Esq., offers to the Society, as long as he continues a member of it, the sum of £4 annually, to be distributed in the respective sums of £2, £1, 12s., and 8s., in four several prizes, for the neatest and most correct Maps of some one state, province, or European colony, comprising not less than 400 square miles; or a portion of not less than 100 square degrees of some uncivilized region. These prizes to be called the *Lander Prizes*, in commemoration of those enterprising travellers, Richard and John Lander. The principal rivers, lakes, chains of mountains, line of coast (if any), and territorial line, should be accurately delineated; and the sizes of the most important cities, or towns, with their latitudes and longitudes, should be correctly marked. The maps should be accompanied by the best information (with reference to authority) respecting the great physical features of the country, such as particulars relating to the principal rivers flowing through it; the length of course; breadth at different places; tributary streams, lakes, and canals; periodical rise, average fall per mile, and the rapidity of current; the progressive increase of alluvial deposit, and the obstructions which may be opposed to navigation:—the characteristics of the principal chains of mountains in such country; their general direction, height, geological and mineralogical features, more important passes, limits of perpetual snow, and the elevations at which various trees and plants will flourish on their sides: or information respecting the population of its principal towns and cities with the statistics of their trade and manufactures, or the natural productions of the country, zoology, botany, &c.

It is not expected that each map will be accompanied with information on all the subjects specified: they are named as affording hints to guide the juvenile competitors, and to prompt them to compilation and original research.

FANCY WORK.

Prizes will be given, for the best specimen of Lace-work, Berlin Wool-work, Embroidery, Crochet, &c.; also, for the best Design for pattern for Lace-work or Embroidery.

PLAIN WORK.

Prizes of 10s., 7s. 6d., and 5s., will be awarded for the best made Linen Shirt, and 5s. for the best knitted pair of Socks, by girls under 18 years of age.

ESSAYS, SCIENTIFIC PAPERS.

Communications of interest relating to the county, which may be forwarded to the Society, will, if approved by the committee, be printed and circulated with the Society's Annual Report. The authors are allowed twenty copies, or any extra number at the cost of paper and printing.

FREE LOAN OF DRAWINGS, ETC.

A collection of Drawings and Prints, comprising studies from Raphael, and the Lithographs by Harding and others, has been presented to the society by the Misses A. M. and C. Fox, for the purpose of affording good copies to those school-boys and others who may wish to borrow them. These drawings have been very carefully selected, and it is hoped that their use will tend to prevent the waste of time and the bad taste which are occasioned by using inferior copies.

Persons wishing to borrow any of the above, must be recommended by a member of the Society, and may apply at the Polytechnic Hall, or by letter addressed to the Secretary.

The members and friends of the society are requested to contribute to this collection of Drawings and Prints.

REGULATIONS FOR COMPETITION, &c.

Competitors are divided into four classes:—

The FIRST CLASS consists of Members of the Society; also of persons resident in the county, who pay 3s. to be allowed to compete for prizes. First class competitors are entitled to admission on the first day of the exhibition, at the same time as the members and holders of transferable tickets.

The SECOND CLASS consists of persons of the working orders.
The THIRD CLASS consists of Schools for the higher branches of education.
The FOURTH CLASS consists of Schools for the children of the working orders.
The second, third, and fourth classes may compete for prizes without any subscription, but are not entitled to free admission to the exhibition.
Persons residing out of the county cannot compete for prizes in the Fine Arts, for the Lander prizes, or in School productions, unless they become members of the society.
Two sealed notes should be sent to the Secretary by every competitor, each endorsed on the outside with some distinguishing motto or private mark. One should contain a full description of the article sent, and state the class and department in which it is to compete, the other note should be marked "private," and contain the name and address of the competitor.
Articles sent for competition, and the cases in which they are contained should have the same distinguishing marks as the notes mentioned in the last paragraph.
No person shall be entitled to a prize for any article which has appeared at a previous exhibition, unless some improvement has been made to it.
In the department of the Fine Arts, competitors should be careful to state whether their productions are originals or copies.
It is optional with the judges, either to award a medal, or a sum of money instead of it according to the following scale :—

First Silver Medal	£7	0	0
Second ditto	5	0	0
First Bronze Medal	3	0	0
Second ditto	1	10	0

Medals only, not convertible into money, can be awarded to patented or registered articles.
Persons who may have medals awarded to them shall not be at liberty to exchange the same for their nominal value in money, unless they have received similar medals at any previous Exhibition of the society.
No competitor may receive more than one medal or prize for similar subjects in the same department at the same Exhibition. (This regulation does not apply to mechanical or scientific inventions.)
No holder of a medal or prize can be allowed to compete for a prize of the same, or a lower value, for similar subjects in the same departments at the *next* two subsequent Exhibitions.
The carriage of all articles sent to the Exhibition must be prepaid, unless permission to the contrary has been previously obtained from the committee.
As much inconvenience has arisen for the late period at which articles have been sent in for competition, it is particularly requested that on all occasions such articles shall be delivered at the Polytechnic Hall *one week* before the first day of the Exhibition, that the merit of each article may be better ascertained, and the arrangements facilitated.

RULES FOR MEMBERSHIP.

An annual subscription of 5s. and upwards constitutes membership of the society.
Each member is entitled to a non-transferable ticket, giving admission at all times to the annual exhibition and lectures, for a subscription of 5s.; and a transferable ticket for every additional 5s.; and is allowed to compete for any of the prizes offered by the society.
Annual subscribers of 10s. and upwards are entitled to the society's Reports.
Subscribers, not resident in the county, paying 5s. and upwards annually, or who become life members by paying £5, are entitled to the same privileges as county subscribers of 10s. and upwards annually.
Subscriptions become due, in advance, at Midsummer, and no person is considered a member until his subscription is paid.

PICTURES BY PROFESSIONAL ARTISTS.

The society invites Professional Artists to forward their works to the exhibition, the carriage of which the society will pay; and as an inducement for them so to do, the Art Union of Cornwall has arranged to select their prizes from the pictures so exhibited.

N.B.—The Exhibition takes place in the Autumn of each year, and notice is given of the exact date some weeks previously.

Any other information respecting the society may be obtained from the members of the committee; or the agents in the county, from whom the Reports of the society may be obtained; or from the secretary,

Mr. SYDNEY HODGES, Falmouth.

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THE ROYAL CORNWALL

POLYTECHNIC SOCIETY.

ESTABLISHED A.D. 1833.

THE TWENTY-EIGHTH

ANNUAL REPORT.

1860.

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PRESENTS TO THE SOCIETY DURING THE YEAR 1860.

Silliman's American Journal of Science. From the Editors.

Annual Reports of the Plymouth Institution, and Devon and Cornwall Natural History Society. From the Plymouth Institution.

Proceedings of the American Philosophical Society. From the Society.

First Report of a reconnaisance of the Northern Districts of Arkansas, United States of America. From the Smithsonian Institution, Washington.

United States Patent Office Reports, viz., Mechanics, vols. 1, 2, 3, 1857; ditto, 1, 2, 3, 1858. Agriculture, 1856, 7, 8, 9. From the Smithsonian Institution, Washington.

Publications of Learned Societies and Periodicals in the Library of the Smithsonian Institution, Washington, D.C., United States of Ameiica. From the Institution.

Report of the Superintendent of the United States Coast Survey for the year 1857. From Professor A. D. Bache.

Journal of the Royal Dublin Society. From the Society.

Journal of the Royal Geological Society of Dublin, vols. 3 to 8. From the Society.

Journal of the Franklin Institute, Philadelphia, 1860. From the Society.

Journal of the Society of Arts, London, 1860. From the Society.

Quarterly Journal of the Chemical Society, for 1860. From the Society.

Memoirs and Proceedings of the Literary and Philosophical Society of Manchester. From the Society.

Proceedings of the Literary and Philosophical Society of Liverpool. From the Society.

Proceedings of the Royal Institution of Great Britain. From the Institution.

Transactions of the Royal Scottish Society of Arts. From the Society.

Proceedings of the Institution of Mechanical Engineers, Birmingham, 1847 to 1860. From the Institution.

Forty-first Annual Report of the Royal Institution of Cornwall. From the Institution.

Greenwich Magnetical and Meteorological Observations, 1858. From the Royal Society.

St. Helena Magnetical and Meteorological Observations, 1844 to 1849. From the Royal Society.

List of the Council and Fellows of the Royal Society. From the Royal Society.

Relation of the blind to the world around them. A short sketch of the life of John Klein. Apparatus for teaching the blind arithmetic. Model of a reflecting tube, for the use of soldiers in the trenches. From the Rev. W. Taylor.

On the construction of Life Tables, illustrated by a new life table of the healthy districts of England. By W. Farr, Esq., M.D., F.R.S. From the author.

On Health, as depending on the condition of air, and on a new patent process for the purification of air. By J. White, M.R.C.S. From the author.

Experimental Researches on the Granites of Ireland; on the Iron Ores of Carnarvonshire. Notes on Mineralogy, No. 3. Ditto, No. 7. On Serpentines and Soapstones. On some Rocks and Minerals from Central India, including two new species—hislopite and hunterite. Ditto, No. 8. On the Felspar and Granite of Canton. On the Black Mica of the Granite of Leinster and Donegal, and its probable identity with Lepidomelane. By the Rev. Samuel Haughton, Fellow of Trinity College, Dublin, and Professor of Geology in the University of Dublin.

ANNUAL GENERAL MEETING.

The Twenty-Eighth Annual General Meeting of the Royal Cornwall Polytechnic Society was held in the usual place, on Tuesday, the 22nd day of January, 1861. J. J. Rogers, Esq., M.P., in the Chair.

The Secretary read a letter from Sir C. Lemon, Bart., explaining the reason of his absence.

The Secretary then read the Report of the Committee and the Treasurer's Report, together with a list of presents to the society during the past year.

Resolved:—That the Report of the Committee and the Treasurer's Report be adopted and printed.

The revised list of prizes and premiums was then submitted.

Resolved:—That the revised list of prizes and premiums be adopted for the ensuing year.

Resolved:—That the following gentlemen be elected Vice Presidents of the Society, in place of those retiring by rotation. T. J. A. Robartes, Esq., M.P., N. Kendall, Esq., M.P., J. J. Rogers, Esq., M.P., Robert Tweedy, Esq.

Resolved:—That the Officers and Committee be re-elected, and that the following gentlemen be added to the list of the Committee for their several districts.

Capt. C. Thomas,	Mr. J. M. Williams,
Mr. J. Hughes,	Dr. Drake,
,, J. B. Read,	Mr. J. Tremayne,
,, J. Poole, jun.,	,, J. St. Aubyn, M.P.,
,, M. Punnett,	,, F. H. Thomas,
,, W. Hooper,	,, J. D. Freeman.

The following votes of thanks were then passed:—

To those Ladies and Gentlemen who kindly lent specimens of the Fine Arts, Curiosities, &c., for the last Exhibition, and who are severally named in the Report of the Committee.

To those Ladies and Gentlemen who so efficiently acted as judges at the last Exhibition.

To those Gentlemen who kindly made Presents or Donations to the Society during the past year.

To those Institutions which have kindly presented books and papers of their proceedings to the Society.

The Secretary then submitted Mr. R. Taylor's suggestion that the Reports at the Annual Exhibition, should be read in the committee rooms, in order that they may be more conveniently heard, and that discussions on the subject might thereby be invited; and it was

Resolved:—That Mr. R. Taylor's suggestion be referred to the consideration of the committee.

The Secretary then read a letter from Mr. R. Hunt, on the subject of the Miners' Association, extracts of which are introduced in the Report of the Committee; and in reply it was

Resolved:—That the Polytechnic Society desires, through Professor Hunt, to express its lively interest in the prosperity of the Miners' Association, and its desire to promote the object of that Institution by any means in its power.

The Secretary then read letters from Mr. Enys, on the subject of the trusteeship of the hall, together with the report of the Sub-Committee appointed to examine the deeds; and it was

Resolved:—That in accordance with the suggestion of the Committee, a sub-committee be appointed, consisting of Mr. A. Fox, Mr. J. Freeman, Mr. R. R. Broad, Mr. H. Bradfield, Mr. W. Phillips, Mr. T. Rogers, and the Secretary, for the purpose of arranging or liquidating the debt on the hall.

Mr. E. B. Tweedy then entered into a statement of the circumstances connected with letting the hall, which had occurred since the last Annual General Meeting, and submitted the following resolution—

"That in order to avoid all unpleasant feeling amongst the subscribers to the Royal Cornwall Polytechnic Society, the Hall shall in future only be used for the promotion of art and science, and such charitable and philanthropic purposes as the Committee may think right, it being understood that it shall never be let for hire except to the County Court until another hall be provided for it."

This was seconded by Mr. T. H. Tilly.

Mr. J. Freeman moved as an amendment, "That the Committee be empowered to let the hall for any purposes which are according to law."

This was seconded by Mr. W. J. Genn.

The amendment and the original resolution were put to the meeting. For the amendment, 20; for the original resolution, 6; majority for the amendment, 14.

Resolved:—That the Hall Committee consist of the following members, and that they have full power to enter into any arrangement for letting the Hall for the current year, for any purposes which are according to law:—Mr. W. J. Genn, Mr. Howard Fox, Mr. J. Bennetts, Dr. Vigurs, and the Secretary.

Mr. Rogers then left the chair, which was taken by Mr. A. Fox, and it was

Resolved:—That the warm thanks of the meeting be given to Mr. Rogers, for his very efficient conduct in the chair.

REPORT OF THE COMMITTEE.

1860.

The progress of the Polytechnic Society, through a period of twenty-eight years, has been of so uniform and unvarying a nature in the results of its Annual Exhibitions, and in the steady interest which has been evinced in its welfare, that in presenting their Twenty-eighth Annual Report, your committee feel that they have only to point out those more prominent features which distinguish one exhibition from another; and again to record with gratification, that the energy and zeal which were so prominent in first establishing the society, are still exerted to maintain it in all its original vitality, although a period of more than a quarter of a century has elapsed since its formation.

Your committee had occasion last year to call attention to the increased interest the Society is exciting in the more distant parts of the country. However much its objects may be valued in our own immediate neighbourhood, it is pleasing to reflect that those who are brought into connection with it, even in the most remote parts of the kingdom, are still more warm in the expressions of their opinion of the value of a society of this kind. The letters of acknowledgment from inventors, to whom medals have been awarded, are generally of a most flattering character; and the avidity with which men of repute and position in the scientific world seek for this distinguishing mark of approval, is one among many of the proofs of how useful its sphere of operations has been, and how increasingly useful it may continue to be with each succeeding year.

In addition to the influence and interest which, through the workings of the Society, are brought to bear upon distant places, your committee think they may again revert to its immediate influence upon the surrounding neighbourhood. When it is considered how many hundreds of people of all classes, yearly throng within the walls, people in the humblest ranks of life, as well as the highest, and where they have the opportunity, revisit it again and again, to derive instruction and amusement from the multifarious articles collected together; and considering the remoteness of our town from the great centre of civilization and advancement, it must be at once evident how much enlightenment and improvement must be effected by means of the society in the minds of those who have possibly no other opportunity of becoming acquainted with the great leading facts of the day, with the most recent advancements of science, and the latest productions of art.

By means of the annual presentation of reports and proceedings by which the Society is so abundantly favoured by other and similar institutions, your members have also opportunities of becoming acquainted with the progress and discoveries of science, not only near at hand, but in very remote districts. You have only to glance at the list of those publications with which the Society is regularly supplied, to see how much valuable information may be obtained within our own walls by those who are desirous of seeking it. The additions this year in exchange for our own report, are the "Journal of the Society of Arts," and the "Proceedings of the Institution of Mechanical Engineers," which latter institution has presented in addition, a set of their reports, as complete as they were able to supply.

It is a source of great pleasure to your committee, as indeed it must be to all those who are interested in the objects of the Society, that they have this year to record the complete establishment of the scheme for the education of miners, which had its origin two or three years ago within these walls. We all know the anxiety which was expressed by many members of the Society, to carry out some scheme that might encourage and direct the naturally enquiring mind of the working miner. Under the able superintendence of Mr. Robert Hunt, a scheme has now been matured, which is receiving encouragement and support from all parts of the county; and your committee refer with much pleasure to the words of Mr. Hunt himself, on the subject, in a letter received yesterday by your Secretary. He writes, "I am very desirous, as the Miners' Association had its origin within the circle of the Polytechnic influence—indeed within the walls of its Hall—to secure from the parent, an expression of true parental feeling towards the child. The infant association can now boast of 200 subscribers; subscriptions to the amount of £250 per annum have been already secured. Four classes are at work (St. Just, St. Agnes, Lostwithiel, and Tywardreath), and other districts are anxiously asking for the services of our teacher. I trust, immediately after the general meeting, we may be in a position to appoint a second teacher. Therefore, I do not think the Polytechnic should be other than pleased with its offspring;" and again he says, "By educating the miner, which is the great object of the Miners' Association, I hope we may quicken those natural powers which the Polytechnic desires to stimulate; and I see no reason why the annual meeting of the Miners' Association should not be made to add to the interest of the Polytechnic Exhibition."

In referring as usual in this preliminary manner to the Annual Exhibition, your committee are happy to record the fact that the hall was as well filled on the last occasion as it has been in any previous year. In fact, the entries in some departments, far exceeded those of former years. The mechanical department was this year extended over a considerable extra space, and in the Natural History Department, the contributions were unusually abundant. In the former, the principal object bearing upon the subject which engrosses the chief attention of your members—the mining interests—were Mr. Borlase's ingenious contrivance for separating ores. The judges considered it very desirable to encourage inventions of this kind, and have awarded it a first bronze medal, and if it should prove as efficacious when worked on a large scale, it will indeed be a valuable accession to the mining interests of the county. Mr. J. N. Hearder, a very old and esteemed contributor has this year obtained the first medal of the Society for his machine called the Inductometer, which is considered a valuable addition to electrical science. A detailed description of this machine will be found in another portion of the report, together with descriptions of other objects of interest in this department.

It will be unnecessary for your committee to enter into any detail with respect to the other departments as a *resume* of the whole exhibition, will appear in its proper place; but they cannot refrain from mentioning especially the obligation they are under to Messrs. W. and J. Freeman, for the very exquisite specimens of polished granite, which again adorned the hall, exceeding in beauty and workmanship anything of the kind that has ever been produced before. Indeed, these beautiful results of art, as applied to the native products of our Cornish hills, must ever awaken a leading and predominant interest in an exhibition of this kind. In another department also, you are under a deep obligation to our respected member, Mr. S. Gurney, for the loan of his valuable picture "The Terror in the Ice." This gentleman has, indeed, always been foremost in contributing pictures of the highest class to this department of our exhibition, and thereby affording the people of the neighbourhood an opportunity of seeing and enjoying works of art of such a class as many amongst them, in all probability, might have no other means of witnessing.

The warmest thanks of the Society are due to two gentlemen, who this year, took upon themselves duties of no ordinary character in helping to carry out the objects of the Society. Mr. J. J. Rogers, who undertook the arduous duty, not only of chairman of the Fine Arts Committee, but president of the first day's proceedings, and Mr. R. Taylor, also undertook the equally arduous part of chairman of the Mechanical Department, a position which, to fill efficiently, involves an amount of general knowledge of science and mechanics, which it is difficult for the uninitiated to understand. The perseverance and impartiality with which they both fulfilled their respective tasks is well-known and calls for our warmest thanks. You are this year especially indebted also to Mr. H. C. Salmon, for his excellent and instructive lecture on "The Origin of Crystalline Rocks," and his equally interesting paper on mineral veins. To Dr. Bullmore also, for his excellent report of the Natural History Department, and to all those ladies and gentlemen who represented the various departments and acted as judges on the occasion. Your thanks are also due to Captain Wodehouse, R.N., Captain Tilly, Dr. Drake, Mrs. Phillpotts, Mr. H. Tilly, Mr. Donald, Mr. J. V. Downing,. Mr. Batting, Mr. Blamey, and your old friend and contributor, Mr. W. P. Cocks, for their valuable contributions of pictures, curiosities, &c., and general assistance during the exhibition.

It was the painful duty of your committee last year to record the death of a lady who, together with her late husband, had ever been foremost in promoting the objects of the Society, Mrs. G. C. Fox. On the present occasion, they have to lament the death of another member of that family, which has ever been associated most closely with you—Mrs. Barclay Fox. The interest with which this lady regarded the Society, her liberality in awarding premiums, and the encouragement she always held out, more especially to the younger members, makes us feel the extent of the loss still more deeply. The names also of Mr. S. T. Fox, Mr. Hender Rogers, Mr. E. W. Williams, Mr. E. Crouch, and one of the hon. members, Professor Powell, swell the list of those members who have been removed from us by the hand of death. The three former were members of the committee, and firm friends of the society.

With regard to the finances of the Society, the Finance Committee have first to report that by the death of Mrs. Hopkins, an annuity of £20, which has been paid to her ever since the erection of the hall, falls to the Society. They have this year entered upon a more detailed classification and analysis of the expenditure, which shows by a glance at the balance sheet, the relative expenses of the different branches of the Society, in a much clearer manner. It is found that as much as £71 has been paid in the past year for liabilities incurred in the two previous years, so that although the sum of £40 was drawn from the reserve fund last year, the Society financially, is in a better condition from the fact of its present estimated liabilities not exceeding £20, while the unpaid subscriptions amount to upwards of £30, and the balance in the hands of the treasurer is £13 0s. 8d.

Your committee calls the attention of the Annual Meeting to the debt on the hall amounting to about £300, which has been standing now more than twenty years, and which they are of opinion should be liquidated with as little delay as possible, they therefore recommend that steps should be taken to remove the burden. It would be very desirable if the subscriptions of the society could be increased so as to cover its absolute working expenses, independently of the rent derived from the hall, which rent since 1840 has been relied upon as one source of revenue, and the expenditure of the Society proportionably increased.

THE ANNUAL EXHIBITION.

The Twenty-eighth Annual Exhibition was opened on Wednesday, September 19th. In nearly every department it was equal to the exhibitions of former years, and in some respects superior. In the body of the hall, amongst the mechanical models and inventions, though belonging more correctly to the fine art department, were displayed a number of truly beautiful specimens of sculpture, contributed by Messrs. W. and J. Freeman, of Penryn. They were not only more numerous, but far more beautiful than any contributions which these gentlemen have made to any previous exhibitions, and they present pleasing proof of the high finish to which granite can be worked. The first of these productions was a large and finely cut and modelled vase, 2 feet 11 inches in diameter, and 3 feet 3 inches high, standing on a fine pedestal, the vase being formed of granite from the Constantine and Trewoon quarries. The raised ornamental work encircling the bottom of the vase was left dead or unpolished, and this contrasted finely with the polished portions above and below it. In addition to several other specimens of the same kind, they also exhibited a good specimen of "Iona" work, consisting of a block of granite, one side of which was ornamented by a Greek cross, and the other by two equilateral triangles emblematic of the Trinity. The last specimen of granite sculpture was the statuette of a child holding two fishes, which was executed entirely by Thomas Couch, a working stonecutter residing at Penryn. It is cut in granite from the Trewoon quarry, and is 2 feet 3 inches high; it from a plaster cast, and the easy grace of the figure and innocent infantile expression of the face have been admirably preserved. When the hard and stubborn character of the materials in which the figure is cut, and the fact that Couch is entirely self taught, are considered, the work must be regarded as a truly astonishing performance.

THE MECHANICAL DEPARTMENT.

The articles in this department were displayed on tables at the top of the room and on the floor of the hall. The first object to be noticed was a complete and handsome model of Messrs. Clayton and Co's patent brickmaking machine, which has effected such an improvement in the manufacture of bricks in various parts of the country. Mr. Edward Borlase, of Hayle, exhibited a model of a machine for separating metals and metallic ores from their grosser associates. In this invention, the water and stamped ore are conveyed to the machine through a launder, whence they fall into a circular distributor, and then pass off through pipes or shutes into a large circular basin or tank. This has a rocking motion, which can be imparted to it either by steam or water power, and it works with such rapidity and force as to keep the mixture always in solution. While in this state the ore sinks by its gravity below the rubbish with which it was mixed, and the waste remaining on the top, is carried towards the centre, where it passes over a raised ring and is thrown off as useless. This ring can be raised or lowered by means of cone pullies so as to suit the quality of ore to be operated upon. A full-sized machine is seven feet in diameter. Messrs. Newton Wilson, and Co., of High Holborn, London, exhibited eleven of their very elegant looking sewing machines, including two highly ornamental and beautiful lady's boudoir machines, which, from their elegant appearance and tasteful finish, would form an appropriate addition to a lady's room; eight of the handsome machines invented by Grover and Baker, Boston, United States, and a cottage machine. In addition to these, they also exhibited a binding machine, which puts on the binding without the necessity of previously tacking it. To one of Grover and Baker's machines was attached Mr. Newton Wilson's patent hammer, and as this turns down the head or seam, the double process of folding the hem and stitching is carried on at the same time. This machine is calculated to work comfortably at the rate of 1,500 stitches per minute, but it can be worked up to 1,800 a minute. The prices of the machines vary from five to thirty-five guineas. The machines were exhibited in operation by an agent of Messrs. Newton Wilson and Co., and they formed objects of general interest and curiosity to visitors, especially the female portion of them. Mr. Roberts, cabinet-maker, of Falmouth, exhibited amongst a very fine collection of cabinet furniture, two patent nursing chairs, the invention of Mr. Newton Wilson. Mr. Roberts also exhibited a patent carpet sweeper by the same inventor, which both sweeps the dust and takes it up without causing any dust in the room. Mr. Hearder, of Plymouth, exhibited a new stove or cooking apparatus, which is stated to possess considerable advantages. Mr. Hearder also exhibited a new instrument, named an inductometer, for determining the inductive capacity of dielectrics, or for testing telegraphic cables, by which the electrical quality of a single foot of cable can be easily ascertained. A model of one of Azimuth's dials was exhibited by Capt. Toovey, of London; and Messrs. Tangye, Brothers, of the Cornwall Works, Birmingham, exhibited two or three models of Dentists' patent hydraulic presses, of 20 tons power. Mr. Abernethy, the engineer-in-chief of the Falmouth docks, exhibited models of a portion of the Prince of Wales' breakwater at Falmouth docks, now in course of construction; the inner and outer sections of the breakwater at Blyth, on a scale of half an inch to one foot; and a design for Swansea breakwater, on a scale of one inch to six feet. In connection with these models there hung in front of the platform the working plans and sections of the Prince of Wales' breakwater, and the graving and floating docks now in course of construction or proposed to be constructed at Falmouth. Messrs. Stephens and Son, of Ashfield, contributed samples of wire rope suitable for mines, inclines, and ships, they being the only manufacturers of wire rope west of Bristol. There were also exhibited a deep sea pressure guage, by Mr. H. Johnson; an ingenious apparatus for teaching arithmetic to the blind, and a reflecting tube for soldiers in the trenches, by the Rev. W. Taylor; specimens of copper branch pipes, on an improved principle, by George Williams, apprentice, Hayle Foundry; two air purifying hand ventilators, by Mr. J. White, Finchley; models of an improved safety valve, and a boiler and flue on an improved principle, by T. Broadbent, Milne Bridge; a model of the calculating portion of Scheutz's calculating machine, with specimens, from Dr. Farr, Registrar General's office, Somerset House; Gifford's patent self-acting water injector, by Messrs. Sharp, Stewart, and Co.; lamb feeder, for the use of shepherds and farmers, by Mr. N. Sibley, St. Lawrence; specimens of electro block printing, by the Electro Block Printing Company, London; a meter for craniums, for wigmakers' use, by Mr. Joseph Williams, jun., Plymouth; models of chemical furnaces, muffler, assay pots, plumbago melting crucibles, &c., by the Patent Plumbago Company, London; a miner's theodolite, by Messrs. W. H. Wilton and Co., St. Day; an improved hand drill, for boring brass, iron, or wood, by Mr. T. C. Chappell, Tuckingmill; a model of a direct action steam crane, by Mr. R. Morrison, Newcastle-on-Tyne. Mr. T. Learwood, of Truro, exhibited two or three articles, of his own invention, which are likely to prove of great benefit to invalids. M. F. Joubert exhibits specimens of engraved copper plates acieraged—a process by means of which it is stated any engraved copper plate can be steel-faced and a very large number of impressions taken, as the steel coating can be removed from the plate as soon as it begins to show signs of being worn, and a further coating placed on without any possible injury to the original plate. "From bank note plates so acieraged several thousand impressions have been obtained, and the plates were found to be uninjured when the printing was completed."

THE FINE ART COLLECTION.

This year the walls on which the pictures are suspended were covered with red drapery, on the same plan that was adopted at the exhibition of the Royal Academy, which is a great improvement, as the drapery shows off the pictures to much greater advantage than the dull grey walls of the room. The place of honour amongst the works of professional artists, which occupy the centre of the gallery, was justly assigned to Mr. E. W. Cooke's, remarkable picture of "H.M.S. Terror in the Ice," which formed one of the most striking productions in the exhibition of the Royal Academy, and which is the property of Mr. S. Gurney, M.P., by whom it has been kindly lent. On either side of this were two fine landscapes, exhibited by an old contributor, Mr. W. Williams, of Topsham; and above these were a well painted landscape, a scene in Norway, by West, and a very striking picture entitled "The Dream of the Hound," by Mr. J. Earl, of London. Mr. Philp had two striking water colour paintings at this end of the room, views of Whitsand Bay and Mousehole, Mount's Bay. There was also a fine landscape by Boddington, of a Welsh scene; and a large picture by Mr. Sydney Hodges', representing a girl and child at a stile on their way to the harvest field, very nicely painted. Mr. Hodges also exhibited in other parts of the gallery a picture "Guinevere in the Convent," suggested by Tennyson's poem; a repetition of his picture of last year, "An Eye to Windward," and several portraits, amongst which those of the Rev. H. Phillpotts, Mrs. Wodehouse, and Capt. Banks, of Penryn, were the most prominent. The portrait of Mr. Phillpotts was presented to Mrs. Phillpotts, his mother, by the parishioners of Budock. Mr. Callaway, of London, a native of Cornwall, exhibited a capital picture of a scene in the Taming of the Shrew, the expression of the chief actors being admirably pourtrayed. Mr. Lenderyou, formerly of Truro, who has this year withdrawn himself from the class of amateurs, and exhibits amongst the professional artists, had a picture, a view of the Thames, which displayed a marked improvement on his former productions. There were four clever sporting sketches by Herring; and Mr. Downing, Mr. Batting, and Mr. James Donald also contributed some good pictures to the exhibition. Mr. Hart occupied his usual place in the centre of the gallery on the left hand side. Among his contributions was a very forcibly painted picture, entitled "After a Storm—low water." A water-colour drawing by the late Mr. S. Cook, of Plymouth, "A View of Polperro," sent by Dr. Drake, deservedly attracted much attention, being a very good specimen of the works of that clever artist. Among the amateurs, Mr. J. Squire, lately of Truro, but now residing at Camborne, deservedly occupied the first place; and he has this year obtained the highest prize of the society for five very beautiful water-colour pictures, the principal one being a view of Gwithian Sands after a storm. It is a most creditable circumstance, that the only two occasions on which Mr. Squire ever exhibited at the Polytechnic—this year and last—he should on the former occasion receive the society's second silver medal and this year their first.

NAVAL ARCHITECTURE.

The display of models in this department was large and excellent, many of them being remarkable for the superior workmanship which they exhibited, particularly those sent by Mr. Bennett, of Padstow. There were numerous models of various descriptions of sailing vessels, steamers, and rowing boats. The most important model in this department was that of the lifeboat adopted by the lifeboat institution, together with the carriage for conveying it from place to place, invented by Captain Ward, R.N.

NATURAL HISTORY DEPARTMENT.

The exhibition in this department was much superior to the collections at any meeting of the society for many previous years. Mr. Edwin Jennings, of Penryn, exhibited a very valuable collection of birds and reptiles from Western Australia, which had been shot, skinned, and preserved by himself. Amongst the varieties were a fine specimen of that rare member of the feathered tribe the lyre bird, a black cockatoo, two golden legged paroquets, a mountain drake, and a whistling duck; the Iguana, the Frill Diamond, and other lizards. Amongst the

British birds were fine specimens of the golden eyed duck, the pentail, and other rare birds. Dr. Bullmore, of Falmouth, is a large exhibitor in this department, having sent several cases of birds and animals. Mr. N. Tresidder, of Falmouth, exhibited a fine specimen of the Nupean or East India pheasant, and East India partridge. The former was shot on the Himalayas in 1857, and it derives additional interest from the fact that the notorious Nana Sahib formed one of the party by whom it was bagged. Amongst the other objects exhibited in this department deserving of notice, were a valuable contribution to the Fauna of Cornwall, by Mr. W. R. P. Cocks, and an addition to the monograph sent last year by Mr. Jonathan Couch, of Polperro; a beautiful collection of seven pans or tanks of actiniæ and other zoophytes exhibited by Miss Mary Vigurs, nearly all obtained in the neighbourhood of Falmouth, to which the society has awarded their first bronze medal; specimens of a young and old opossum, sent by Mr. Jennings; and four cases of very beautiful specimens from the Materia Medica, arranged by Mr. F. Polglase, an apprentice. The whole formed a very valuable and beautiful collection, the brilliant plumage of the Brazilian birds contrasting finely with the more sober colouring of their British relatives.

THE ANNUAL MEETING.

The weather, which during the early part of the morning had been wet and tempestuous, by twelve o'clock had taken a very favourable turn, and soon after the hall became filled, as usual, with a large and fashionable assembly, gathered together from all parts of the county. Soon after one, the president, Sir C. Lemon, together with the judges and committee, ascended the platform.

Sir Charles Lemon rose and said—I beg to move that Mr. Rogers, who has kindly consented to preside for me, be requested to take the chair.

Mr. Rogers, M.P., then took the chair and said—Ladies and gentlemen, I have been requested by our respected and honoured president, Sir Charles Lemon, to take the chair to-day, and to introduce to your notice the objects of interest around you. I must, however, first congratulate the society on having a much more favourable day for our meeting than we could have anticipated this morning. I am also glad to see the whole of the hall filled not only with the art contributions and other objects of interest, but with ladies and gentlemen, many of whom have come from a distance to inspect the exhibition. Before the reports relating to the various departments are read, I will just glance at a few of the leading or more prominent objects which are ranged before us. In the mechanical department I believe I may say that there is a very good exhibition. The difference between the present and former exhibitions lies in the fact that the most valuable articles come from a distance, and are not the productions of our county. That is one of the advantages resulting from the introduction of railway communication—it enables exhibitors to bring here heavy and cumbrous articles from a distance; and I am sure we may congratulate ourselves upon thus having the means of stimulating the talents and abilities of our own native inventors. I will not attempt to describe minutely any of the mechanical inventions which are exhibited here, because I am sure you will have a very full and careful report upon the subject from Mr. R. Taylor, who has been kind enough to act as chairman of the committee of that department. I may, however, briefly refer to one or two objects of a more prominent and popular character; and first, there are some very beautifully made sewing machines. On viewing them, we must not suppose that because they stitch with such prodigious rapidity, that the poor persons who gain their living by sewing will be thrown entirely out of employment, and it may be satisfactory to you to be informed that the capacity of these machines, great as it is in some respects, is very limited indeed in others; and that there are many things which they cannot accomplish. They are, however, fully deserving of your attention, because they are not only very varied in character, but are of such nice construction as has never before been seen here. I believe that this important invention is an American one. There is another and a very interesting instrument, of which I trust we shall have a full and interesting description from the exhibitor, Mr. Hearder, called the inductometer. I will not attempt to puzzle the ladies who are here with a description of this machine, but I may state it is one which is likely to be of great value to electricians who have to do with the management of electric currents. Thus far with regard to the mechanical and scientific inventions, of which you will hear full details from Mr. Taylor. I will now just glance at the fine art department. It may appear to some of the visitors that the walls of the hall are not so well covered as usual; but on inspection, the contributions will be found to contain some excellent specimens of art from the hands of artists belonging to our own county. Some of these deserve especial notice, and will be referred to more particularly in the report on the fine art department which will be read to you. I may explain that the paintings have on this occasion been arranged in classes —the oil paintings and water-colour drawings together, and the amateur paintings and drawings and school productions together, which I think you will allow is a great improvement. I am sorry to say that although the department generally is good, there are some branches not so well represented as we should wish. This is particularly the case with respect to the school productions, in which there is a falling off. This may probably be attributed to the fact of there having been an exhibition at Penzance lately of the productions of schools, and perhaps those who have the management of those exhibitions will do us the favour in future to arrange them to be held at a time of the year that will not clash with our exhibition, so that we may avoid the disadvantage of having the two exhibitions so nearly together. Among the home productions in the mechanical department, I am glad to see that this year has produced some coils of wire rope, because in this county it is of very great importance that we should possess manufactories of this article at home, instead of having to send about the country for it. This is the first time that any has been exhibited here of Cornish production. Persons interested in mining adventures and other operations will be glad to see that there are very good coils of wire rope which have been made in Falmouth. There are several beautiful specimens of polished granite, and I would particularly call attention to the statuette before me. Of tools there are not many exhibited to-day. We have to thank many of our old contributors and supporters, and also some new contributors for the handsome exhibition of pictures. There are not so many specimens of ancient art as on some former occasions; but through the exertions of our valued secretary, we have a large number of pictures by modern artists, which are deserving your close attention. In natural history, those who are interested in that department will be glad to learn that there is a fuller exhibition than usual. This is an important branch of study, and one which can be carried on by persons of both sexes, and of any age. In statistics, we have this year, as we had last, an important paper which will not be read; but it is recommended to be published in the next annual report of the society. It has been contributed by Mr.

Couch, of Penzance, the eminent surgeon, and is on the subject of the mortality among miners. It will interest persons who have studied his former papers on the subject, to be told that he proposes next year to systematise the contributions which he has been so kind as to present to the society during the last two or three years, and to endeavour to ascertain what may be the best mode of obviating the evils resulting to miners from the nature of their employment. Everyone who is interested in Cornish miners will rejoice to know that so able a gentleman has engaged to devote his attention to this subject, and we hope that at our exhibition next year we shall have a paper of considerable value from him. There is only one other paper on statistics which will be referred to in the report on this branch. In naval architecture there are some valuable models, and among them there is one which will interest many in this county, with its wide seaboard and exposed coast—I allude to the model of the lifeboat which is at present in use by the Life-boat Institution. This model will convey a very good idea of the boats of the Institution, which are now, I am happy to say, stationed at various points of the Cornish coast; and by means of these boats and the admirable institution to which I have referred, many lives will doubtless be saved which would otherwise perish. Near to the model is a full-sized specimen of a swimming belt used by the National Lifeboat Institution, for the protection of the crews of their boats when engaged in the duty of attempting to save life. The jacket is made entirely of cork, and is put on by the sailors before embarking in the boat. It does not impede the men while engaged in rowing, and in case of an accident occurring by the upsetting of the boat, the man wearing it is kept above water. There are also some very pretty models of other kinds of boats. A novelty in the exhibition this year—for I think I may so term it, consists of two or three specimens of ladies' carving in wood. It is very interesting to see such great boldness and originality as are here shown in the treatment of very hard materials, one of the objects being of oak and the other of walnut, two very hard kinds of wood. I would ask any lady who has a knowledge of wood carving to examine these productions for herself, and I think she will be highly gratified. At the other end of the room is a picture which has been sent here for exhibition by our kind friend, Mr. S. Gurney, which many persons may have seen at the exhibition of the Royal Academy. It presents a faithful and remarkable representation of the icy regions near the North Pole, and the freezing up of the ship "Terror." I believe that the artist, Mr. Cooke, never had an opportunity of seeing the ice fields of the northern regions, and it is therefore the more remarkable that the picture should be in such keeping with the real character of the regions in question. I believe, however, that he has had an opportunity of observing the effect of light on ice, in the glaciers of the Alps; and I am happy to find that in these days of Alpine travel, some good results may be derived from the perils and dangers incurred by travellers in these mountainous regions. Mr. Rogers then congratulated the society on its present condition as evinced by the exhibition of that day, and concluded by announcing the proceedings which would take place.

Mr. R. Taylor then rose, and apologised for not having been able to prepare a written report on the awards of the judges in the mechanical department. The number of objects for adjudication was so great, and some of them required re-consideration up to the latest moment, that it had not been possible to prepare a written report. He had been requested by the judges to make some observations on objects exhibited in the mechanical department; and he trusted his remarks would be received with indulgence. The mechanical department had been much enriched through the kindness of many friends resident in different parts of the country; and the number of interesting objects thus received compensated in great degree, for a paucity of inventions among Cornish friends. The society could not now boast, as at former meetings, of anything very striking or new in the way of invention from Cornwall. They had to thank a gentleman, now in Falmouth, for having added to the exhibition some very beautiful models of breakwaters and other marine structures; among them a model of a portion of the Prince of Wales breakwater at the Falmouth Docks. Of course, these models were not sent in competition for prizes, but the judges had requested permission of the committee to be allowed to award to the man who constructed the model of portion of the breakwater, a small sum of money, in testimony of their satisfaction with his workmanship, which did him very great credit. It was very desirable, perhaps, that he should state that the mechanical department might properly be classified in three portions. In the first place, there were machines and instruments sent for competition, showing excellence either in invention or construction. Next, there was a very large class of machines and manufactures which, having been patented, could not receive a premium here, but which, by a recent change in the laws of the society, might be rewarded by the presentation of the society's medals. Lastly, there were models and other articles sent here merely for exhibition, for the instruction and gratification of visitors. Among the objects sent here to-day for competition, perhaps, the most remarkable was one that might be spoken of now as a Cornish manufacture—if manufacture it might be called—and which had sprung into very great importance. He alluded to the preparation of our granite in such beautiful forms as those in which it was now exhibited by Mr. Freeman. There were, he believed, six or seven very magnificent specimens, and the judges had thought it right to award to the exhibitor the society's highest class premium. In the same department, there were some specimens, excellent in workmanship and in construction, of surveying instruments—two by Mr. Wilton, and a third by Mr. Jeffery. These also had received rewards from the society. There was then another manufacture now established in Cornwall for the first time—that of wire rope. He believed the exhibitor claimed no novelty; the rope being made by machinery such as had been used for the like purpose in other parts of the country. But a careful examination by the judges, satisfied them that these ropes made in Cornwall were at least equal to those made in the north of England. As displaying invention there was a very curious instrument for teaching arithmetic to the blind. Among the judges, there were none, he was sorry to say, who were specially acquainted with the methods already employed for that purpose; but this invention did appear to the judges as fulfilling all the requirements necessary for the purpose. The next object on his list was some copper branch pipes, said to be on a method invented by the exhibitor. He understood that their working was very satisfactory; and certainly the manner in which they were made, appeared to the judges to be far superior to the modes formerly in use. The exhibitor was, he believed, a working apprentice. There was next an ingenious little apparatus for feeding lambs, which he recommended to the notice of farmers. The next object was a universal bed-chair; the workmanship was considered remarkably good, and as it was the work of an inhabitant of this county, it had been rewarded. He had next to notice a meter for the head, intended for the use of wig-makers. Of the importance of this article the mechanics who had to judge of it were hardly able to determine correctly; but it was only right to say that it appeared to do its work very well and in very short time. He next came to a very well executed, and probably a very useful instrument sent here by a working man. It was called a double action spirit level, and it would no doubt be useful in many kinds of manufactures.—Last, but not least on his list, was an inductometer, exhibited by Mr. Hearder; it was an instrument of very high interest, and would probably be found of very great value. It was, however, one that it would be impossible for him to describe adequately; but he believed that to all who wished to understand its operation thoroughly, an opportunity would be afforded of hearing it fully described by the inventor himself. Its object was to test the value and the perfection of cables used for submarine telegraphs, in the several respects in which hitherto there had been no accurate or simple means of measurement. He might say the judges considered that it fulfilled all the required conditions of such an instrument. This closed his list of inventions and manufactures competing for prizes.—Then came the machines and instruments which, having been patented, did not compete for prizes. First on this list was a deep sea pressure guage by H. Johnson. It was a very ingeniously constructed machine, well adapted for its purpose, which was to measure the pressure of the sea at very great depths.—Next was a very beautiful model of a brick-making machine (by Clayton and Co.,) a valuable invention, and well known to be very effective.—The next instrument was an azimuth dial (by Captain Toovey,) for correcting the compasses used on board iron vessels; it was considered to be highly meritorious, and one that fulfilled a very useful and important object.—Next was a self-acting water injector. This instrument was, he believed, a French invention, but it had been adopted and brought into extensive use in this country. It was impossible to say much in explanation of this invention, but he believed it had been stated to do its work well, and it had no pumps or other such complications as were found in ordinary modes of injection. It was also said to be applicable to locomotive engines, and to the mining engines in use in this county. The judges considering it a good instrument, had awarded it a prize.—Next was an hydraulic press, said to be capable of lifting 20 tons, and an hydraulic lifting jack, by the same inventor. The jack might in some respects be more useful than ordinary jacks; and for the two instruments together the judges had awarded one of the society's medals. The next object was a series of engraved copper plates coated with a thin film of steel, so slight as not in the least degree to affect the delicacy of the engraving, while it had the effect of resisting the wear and tear consequent on printing for a much longer time than was possible with copper only; and when the steel coating was worn, another coating could be put on without difficulty. There was next an exhibition of articles in ebonite—a very beautiful composition, partly of Indian rubber. Lastly, there was the exhibition of sewing machines, of excellent workmanship, and appearing to do their work very well indeed. There was also a model of a machine for dressing metallic ores; it was in full operation yesterday, and, on a small scale, it showed the effect of the invention very well indeed. The judges considered it deserving of one of the society's medals; but, at the same time, they did not mean to pronounce an opinion, that being very difficult to determine without long and careful trials. He desired to call the attention of practical miners to the importance of improving apparatus for dressing ores. A valuable contribution to our knowledge in this respect was made last year by his friend M. Moissenet, who had published the result of his observations in a very clever paper, written in French; but he hesitated to publish them in English, thinking it would not be fair to publish information given him in confidence by persons in Cornwall who had afforded him facilities for examining machinery. He, (Mr. Taylor) however, believed he might answer for Cornishmen that they would not object to the publication in England of anything that might tend to advance the art of mining. M. Moissenet was now engaged in a similar series of observations on the dressing of copper and lead ores; he (Mr. Taylor) had advised him to publish the result of his observations in England, and he had no doubt that Cornish miners would derive much benefit from the result of M. Moissenet's researches.

Mr. Sydney Hodges then read the following list of prizes in the mechanical department:—

Machine for separating metals and metallic ores, Edward Borlase, Hayle, first bronze medal. Patent brick-making machine, Clayton and Co., first bronze medal. Apparatus for teaching arithmetic to the blind, reflecting tube for soldiers' use in the trenches, &c., Rev. W. Taylor, first bronze medal. Specimens of copper branch pipes on an improved principle, George Williams, apprentice, Hayle Foundry, first bronze medal. Lamb feeder for the use of shepherds and farmers, N. Sibley, St. Lawrence, prize 10s. Dentist's hydraulic press of 20 tons power, Tangye Brothers, and Price, Cornwall Works, Birmingham, first bronze medal. Miners' theodolite, W. H. Wilton and Co., St. Day, second bronze medal. Model of direct action steam crane, R. Morrison, Ouseburn Engine Works, Newcastle-on-Tyne, first bronze. Universal bed-chair, adapted for invalids, officers on field duty, &c., T. Learwood, Truro, £1. Meter for craniums, for wigmakers' use, J. Williams, jun., Plymouth, 10s. Polished granite pedestal in three stones, base from Eathnewas, shaft from Carnsew, cap from Trewoon; polished vase of Carnsew granite, and ditto of Trewoon granite; fine dressed granite ledger, with carved cross; drinking fountain intended for building into a wall by the roadside, polished with gilt lettering; specimens of "Iona" work in granite, carved and polished, Messrs. W. and J. Freeman, Penryn, first silver medal. Violoncello and bow, W. Old, Falmouth, prize 10s. Model of portion of the Prince of Wales' breakwater, Falmouth docks, James Abernethy, engineer-in-chief of Falmouth docks, prize £1 (for the workmen). Samples of wire rope, suitable for mines, inclines, and ships, J. Stephens and Son, Ashfield, first bronze medal. Grover and Baker's family sewing machines, Newton, Wilson, and Co., High Holborn, London first bronze medal. Double-action spirit level, Captain J. Bennett, of the steamer "Louisa," of Falmouth, prize £1. Miners' theodolite, A. Jeffreys, second bronze medal.

THE FINE ART DEPARTMENT.

The CHAIRMAN read the following report relative to this department:—

The objects entered for competition in this department are neither so numerous, nor so varied as they have been in some former years. The committee, however, have pleasure in drawing attention to some very meritorious works in water-colours, both landscape and flower drawing from nature. It is much to be desired that still more attention should be paid to the latter department of water-colour drawing, as not only is great accuracy in the delineation of form to be acquired by it, and truthfulness in the rendering of nature's best colours, both singly and in harmony with each other; but the study of botany is also at the same time considerably assisted and stimulated by the collection and examination of specimens from which the best drawings are to be produced. Thus, whilst the landscape painter gives us a view of the grandeur of nature's field, the flower painter brings to our notice many a hidden beauty which would otherwise remain unobserved and unadmired. The first silver medal is very gladly awarded to Mr. Squire, for highly artistic drawings in water colours. Nos. 194, 197, and 198. The aerial perspective of the rain clouds and mist in "Gwithian Sands," the sunny brightness of "Looe Bay," and the delicious coolness and transparency of the pool in the "River Scene," deserve the highest praise. The views on the Cornish rivers Camel and Fowey are excellent in another way; for though not so artistically finished, they charm the eye by their poetical beauty of treatment and composition. In the view of Ponsanooth, the original work of an artist of 19 years of age, the drawing of the large wall tree is very commendable, and it is hoped that he will persevere. Amongst flower drawings it is to be observed that No. 199 (by Miss M. L. Scott, Plymouth,) contains proof of taste in grouping, and feeling for colour, though there should be more refinement in the drawing. Nos. 229, 230, and 233 (by Stephen Thomas) are good specimens of flowers from nature by a pupil, aged 18, at the Penzance School of Art, though the well-arranged group from the corn field is scarcely true to nature in the tint of the poppy. No. 235, also by an adult pupil of that school (M. Rogers,) exhibits delicate feeling in the play of light upon the flower petals. No. 238 (by Miss Hooper,) is rewarded with a prize of 5s., because though the flowers are heavily painted, yet it is a first attempt from nature, and as such, deserves notice. A design in two parts from the flower columbine, by a youth of 17, deserves especial mention, not only as the only specimen of its class which is exhibited, but as showing considerable talent for design in colour, in a style which, though conventional, is very pure, and appropriate for modern decoration. In oil painting, only four specimens are exhibited. Two of these have received prizes rather by way of encouragement than as works of high merit. There is much truth of form in the group of flowers, No. 207, (by Miss M. L. Jenkins, Truro,) and the structure of the leaves is carefully indicated, but the colouring is too heavy and loaded. The artist of No. 208 (Miss E. Dunn, Truro,) "The Flower's Revenge," will do well to study carefully some good and simple models, and she will succeed in producing excellent work. The present subject is a little too complicated for her, but shows promise of future success, and much of its detail is carefully drawn and well painted. Nos. 241-2 (by Miss Tucket, Bristol)—two small sketch books of subjects noted during a foreign tour—are commended for the delicate beauty of form and playful variety of subject which they contain. In photography, a good set of stereoscopic and other specimens is exhibited, and a book of ferns, and numerous specimens of M. Joubert's patented process for photographing on glass and china deserve attention as being applicable to decoration of windows, cabinet wares, and chimney pieces. The mauve and rose tints, however, should be purer than they are in some instances. Nos. 202 and 205 (by Miss Magor, of Redruth, and Miss Collins, Ham, near Plymouth,) are bold specimens of carving in hard wood by two ladies, who, it is to be hoped, will continue to favour us with their interesting productions. Crayon and pencil drawings are not so numerous as usual. The bust of Hercules, No. 251, (G. Petherick) is a good specimen of bold drawing, and the egg plant from the cast, by a boy of 16, (T. Kelly) is excellent. Both of these show the value of the models at the schools of art. No. 264, an original sepia sketch by a young man (E. W. Harry, Trevarth School,) shows promise of good free drawing by a boy. The lights are clear, and it is not laboured. Some very careful outlines from flowers and figure subjects will be found in the upper tier, but it is feared that the recent exhibition at Penzance has deprived the hall of many school of art productions, which we hope to have next year. The committee desire again to invite more attention to the premiums offered for ten different subjects from nature, as calculated to direct the pupil to a really useful, attractive, and improving branch of art. In five out of these ten subjects, there is no competition whatever, and scarcely any in the remaining five. This is much to be regretted, and the committee hope to see a much larger exhibition next year both from school pupils and others. In sculpture there is a solitary subject, the statuette of a boy and fish, by a stonemason, in his leisure hours. It deserves praise for the boldness with which a very untractable material has been used, and we would wish him a softer medium than Cornish granite when he next uses the sculptor's chisel. Fewer specimens of ancient masters than usual adorn our walls, but there are amongst the works of living artists many which will repay attention and close study. Observe especially Cooke's "Terror in the Ice," which helps one to realize the severity of those regions where *ulterius nihil est, nisi non habitabile frigus*, and which have now become sacred to the memory of Franklin, who once guided that deserted ship. An excellent coast scene by the late Mr. Cooke, of Plymouth, will also be found, and a mountain scene by West, of Clifton, besides many important and beautiful works of Mr. Philp, Mr. Williams, Mr. Hart, and our valued Secretary, by whose exertions the whole series has been collected. A highly finished specimen of chromo-lithography, executed in Berlin, from Leonardo da Vinci, shows the perfection to which this modern art has been carried.

FINE ARTS.—*Amateurs.*—Gwithian Sands, Looe Bay, River scene, North Wales, J. Squire, Camborne, first silver medal. Book, twelve water colour drawings and sketches, Miss M. L. Scott, Plymouth, prize 5s. Cabinet in oak, designed and carved by Miss Magor, Redruth, made up by T. Dungey, first bronze medal. View in Fowey river, view in the Camel river, Rev. G. Hext, St. Veep, Lostwithiel, first bronze medal. Carved stand and table, Miss Collins, Ham, near Plymouth, second bronze medal. Group from nature, Miss M. L. Jenkins, Truro, 10s. The Flower's Revenge, Miss E. Dunn, Truro, prize 10s. Specimens of nature printing, Mrs. Gutteres, 10s. Book of photographs, Rev. F. E. Gutteres, £1. View at Ponsanooth, T. Knight, £1. Falmouth from the Beacon, J. Strongman, aged 17, 10s. Design from Columbine, R. E. Sargeant, aged 17, £1. Flowers from nature, S. Thomas, aged 18, Penzance School of Art, 15s. Ditto, M. Rogers, Penzance School of Art, 10s. Six sketches of flowers from nature, Miss Hooper, 5s. Two water colours, Miss Cardew, second bronze medal. Book of water colour drawings, Miss Tuckett, Bristol, first bronze medal. Bust of Hercules, G. Petherick, prize £1. Egg plant from cast, T. Kelly, 10s. Sketches from nature, R. E. Sargeant, 5s. Town and Harbour of Fowey, R. J. Stephen, Lostwithiel, 10s. The Fisherman's Home, E. W. Harry, Trevarth School, 5s. Outline flowers from nature, Miss M. Squire, 10s. Drawings from cast and life, Miss B. Squire, 10s. The Domino, Miss H. Bradford, 10s. Flowers from nature, outline, J. Rogers, Penzance School of Art, 5s.

SCHOOL PRODUCTIONS.

The Rev. S. ROGERS read the report on these productions as follows:—

The judges in this department regret to say that there is a considerable falling off in the school productions in art, both in point of quality and number. In water colours there are but four competitors, none of whom, they regret to say, have exhibited original drawings. The judges are much pleased with the water coloured drawings to which they award a prize of 10s., numbers 301 and 302 (Dr. Drake's Academy, St. Austell.) They award 5s. to No. 332 (by E. G. Hocking, aged 15,) as an encouragement, considering the age and class of the contributor, but hope for improvement in keeping of distance and harmony of colouring. There is much promise in No. 320 (J. Donnithorne, Phœnix-place School, Redruth,) a child of 11, to which they award 2s. 6d., recommending that the artist's endeavours should be confined for the present to simple subjects. In pencil drawings, also, the judges could wish that more attention had been paid to drawings from nature. They award 10s. to a copied horse's head, and a careful original drawing of a branch of vine. They award 10s. to the six sketches of branches of forest trees, which they do not consider worthy of the special premium of £1; the veining of the leaves and proportions of the stems being not sufficiently studied. They are glad to observe a slight improvement in the various books of outline drawing from the government models.

SCHOOL DEPARTMENT.

Mr. Rogers also read the following report:—

The judges in this section have to report a marked improvement in the specimen of plain writing which has been brought under their notice, and would urge on schoolmasters and pupil teachers the great desirability of encouraging competition in this branch of penmanship. As an example, they would refer to copy book, No. 375 (by R. Nettell, Trevarth School.) The maps and mechanical drawings require no especial comment on the part of the judges, the productions being very few, and of ordinary merit.

School Productions.—Venice, Haarlem West, Dr. Drake's Academy, St. Austell, aged 14, prize 10s. Trees, pencil, Thomas Pearce, aged 15, from Dr. Drake's Academy, St. Austell, prize, 2s. 6d. Horse's head, outline of vine, E. Griffith, aged 12, from ditto, 10s. Figure from flat, E. C. Farley, aged 14, from ditto, 5s. Book of pencil drawings, G. M. Hicks, aged 8, 5s. Ditto, W. M. Hicks, aged 9, 2s. 6d, Book of pencil outline, E. Pascoe, Wesleyan School, Penryn, 5s. Ditto, C. Abraham, ditto, 2s. 6d. Sea-side view at noon, from models and objects, J. Donnithorne, Phœnix-place School, Redruth, 2s. 6d. Series of drawings from models and objects, Emma Griffiths, British Schools, Truro, 7s. 6d.; series of outline drawing, ditto, 5s.; leaves and branches of British forest trees, 10s. Pencil drawing, J. F. Gloyne, 2s. 6d. Mainporth, E. G. Hocking, 5s. Map of England, and of St. Paul's travels, G. M. Hicks, Bodmin, 5s. Maps of Scotland and Ireland, W. M. Hicks, Bodmin, 5s. Specimens of writing, E. Pascoe, Wesleyan School, Penryn, 2s. 6d. Specimen of writing, W. Morgan, Phœnix-place School, Redruth, 2s. 6d. Map of England, R. Nettell, Trevarth School, 10s. Writing book, ditto, 5s. Map of British Isles, R. Jewell, Truro, 5s. Ten specimens of writing by various pupils, Truro British School, 5s. Specimen of outline drawing, ditto, 2s. 6d.

NATURAL HISTORY DEPARTMENT.

Dr. Bullmore read the following report:—

The Judges in the Natural History Department have great pleasure in reporting that the tables of their department are better filled to-day than they have before been for many preceding years. It affords them great satisfaction to observe that a most marked improvement has been made by several of the competitors of last year, and that the suggestions offered by the committee have been by them carried out in a most praiseworthy manner. The first subject on the list are eight cases of stuffed birds and animals from Australia, shot, preserved, and mounted by Mr. Jennings, of Penryn, marked from 421 to 429, to which has been awarded the second bronze medal. These cases form a most elegant group, and from the brilliancy of their plumage, lend a most attractive hue to this part of the hall; whilst from the scarcity of many of the species, they are considered to be a most interesting and valuable collection. The committee, however, beg to state that in their opinion, their value would be still further enhanced had they been properly named and arranged in their respective genera. Among them we noticed the *Mœnura Superba* or lyre bird, and for the information of those interested in the history of this original species which has caused for so many years so much dispute, I will venture to make a few remarks.—Dr. Bullmore then proceeded to describe minutely the appearance and habits of the bird, referring also to the accounts given of it by Lieutenant Collins, of the Royal Marines, through whom it was first made known in 1788, and Cuvier, and observed that the specimen on the table was in good condition and well preserved. He then continued:—Amongst the other cases of Australian birds, we observed a golden crested cockatoo, two green-legged paroquets, the whistling duck, and the Paradise goose; whilst amongst the animals are the iguana, the ant-eater, the frill and diamond lizards. No. 430 is a collection of land birds. No. 436 is a collection of *Rosaceæ*, by Miss Warren, of Flushing, to which has been awarded £1. This series contains 16 distinct species, which (as far as I can glean from the previous reports of the society,) is the largest number of this family that has been procured in this neighbourhood. No. 433, are six cases of stuffed birds, by J. Couch, of Church-street, Falmouth, to which has been awarded 15s. The committee are pleased to observe with reference to these birds, that much care has been taken with the specimens generally, and more especially with the male golden-eyed duck, which is neatly stuffed and tastefully cased. No. 434, is a case of British ferns, collected and arranged by a farm labourer, named Stephen Vingoe, to which has been awarded 5s. The committee venture to express a hope that he may be induced to continue his studies in this department of natural science. Nos. 435 to 440, are five pans of actiniæ and other zoophytes by Miss M. Vigurs, to which has been awarded the first bronze medal. On inspection, it will be observed that many of the specimens in these aquaria were exhibited last year, since which time they have remained in their present locality. They all seem to enjoy the most perfect health, and are full of strength and activity, clearly showing that these delicate creatures, frail as they are, may, by care and attention, be preserved in a state of captivity for many years. No. 441 is a case of British birds' eggs, by Miss M. Carey, to which has been awarded 10s. 442, a calendar of nature, by Master W. L. Fox, awarded the special premium of £3. 443 and 444—four cases of preparations from the Materia Medica, by Mr. F. Polglaze, awarded 25s. 450, a case of lichens by Miss Vigurs, awarded second bronze medal. 452, is a contribution to the Cornish

Fauna, by Mr. W. P. Cocks, for which the committee beg to return their most sincere thanks. 453 is an addition to the monograph of last year, sent by Mr. Jonathan Couch, of Polperro, for which the society also feel much obliged. 455, is a case containing an East Indian pheasant and two partridges, by Mr. N. Tresidder. These magnificent birds were shot in the Himalaya, cured, and cased by the exhibitor; and even the eyes, he has himself made. The committee consider that the elegance in the plumage of the birds themselves is only equalled by the neatness and propriety of their casing. 458 to 464 are six cases of stuffed birds, by Mr. P. Chapman, awarded 5s. On the whole, the committee have great satisfaction in congratulating the Society on the Natural History exhibition of the present year, and hope that it may continue to be as well represented in future periods as on the present occasion.

The Chairman observed that it was very gratifying as well as encouraging to hear such an excellent and interesting report from Dr. Bullmore relating to this department.

NAVAL ARCHITECTURE.

Captain Wake, R.N., read the report on this department:—

No. 561.—A duplex or capstan windlass, exhibited by Lister and Garrick, the judges consider a useful and practical appliance for working the anchors and cables of merchant vessels, and award the exhibitors the first bronze medal. Nos. 563, 564, 565 and 566, four medals, a Canadian steamer, a half ditto schooner, ditto ship, and an English steamer, exhibited by Mr. S. T. Bennett, of Padstow; the judges commend for neatness of execution, and award a bronze medal of £3 to the exhibitor. No. 569, the life-belt worn by the crews of the life-boats when they go afloat, and the carriage for a life-boat, exhibited by Captain Ward, R.N., the inventor, with one of the National Society's life-boats mounted on the carriage—the judges consider admirably adapted for their purposes in saving life, and award the first bronze medal to Captain Ward. No. 571, the drawing of a sounding log, exhibited by Mr. Grafton Jones, appeared to the judges to be good in principle, but they decline to pronounce judgment as to its practical merits, without seeing the model. No. 572, is the model of a brig, exhibited by George Hunt, of Falmouth; the judges award 15s. for the ingenuity and labour, but they consider the brig to be overmasted, and there are a few slight inaccuracies in the rigging. No. 579, the model of a schooner yacht, exhibited by John H. Geach; the judges commend as a good model and well-rigged; and award 30s. to the maker of it, Mr. Geach, who is a saddler.

STATISTICS.

Mr. Thomas Rogers read the report on this subject as follows:—

The judges have had only two papers submitted to their consideration, the one a tabular comparison of the births and deaths in the several districts and sub-districts of Cornwall, which appears to have some value, although they are of opinion that the competitor draws important conclusions from insufficient data. For this reason they recommend that the tables be published in the report without the writer's remark, and they have awarded to it a second bronze medal. The other paper is an examination by Mr. Couch of the comparative mortality of miners and others in the sub-district of Marazion, in conclusion of his examination of the general mortality of the Penzance district. The judges attach great importance to the communications on this subject, which have been published by your society in former years, and among which those of Mr. Couch have occupied a prominent place. They are, however, of opinion that as the paper which they have now had under their consideration is but part of a series for which the society has already awarded three medals, they do not now award a prize; but as a continuation of former papers, they recommend its publication in the report.

PLAIN AND FANCY NEEDLE WORK.

Mr. Sydney Hodges read the following report on this subject:—

The ladies wish to remark that the object of the society in this department is to encourage useful needlework, and inventions, and they greatly wish that schools would send their work. Miss Molesworth offers a prize of 10s. for the best pair of knitted stockings, provided that three pair at least are sent in for competition, done by children under 14.

LIST OF PRIZES.

The following is the list of prizes awarded at this meeting :—

PLAIN AND FANCY WORK.—Baby's robe, design original, Mrs. E. Rogers, Helston, prize 10s. Crochet counterpane, Miss Essery, Launceston, 7s. Linen shirt, Miss Bawden, Penrose School, 5s. Patchwork quilt, Miss Coale, Falmouth, 7s. Pincushion knitted anti-macassar, and pair of sleeves, Catherine Nicholas, St. Agnes, totally blind and confined to bed, 5s. Patchwork quilt, M. Davey, Chacewater, aged 91, 7s. Ornamental basket, in leather, R. Gloyne, 7. H.M.S. "Russell," in needlework, G. Lobb, 3s.

After this, the Chairman explained what was the order of proceedings on that day and the following one (Thursday), and the business of the annual meeting then terminated.

ITINERANT TEACHING OF THE BLIND.

Shortly after, the fourth annual meeting of the friends and supporters of the effort made for teaching the blind in the county, to read the Holy Scriptures, by raised type on Moon's system, was held in the committee room, Mr. R. W. Fox in the chair. The Rev. E. Tippett, the secretary, read the annual report, which was of considerable length, and gave interesting details of the results which had attended the labours of the agent of the society, amongst the blind in Truro, Falmouth, St. Austell, Redruth, St. Agnes, and other places in the county. On the motion of the Rev. S. ROGERS, seconded by Mr. CHARLES FOX, the report and financial statement were adopted, and ordered to be printed and circulated. Mr. W. HICKS moved, and Mr. R. TWEEDY seconded a resolution to the effect that the teacher, Andrew Thomas, be continued in the service of the society, and that his salary be increased to 17s. per week. The Rev. S. ROGERS next moved, and the Rev. R. B. RICKARD seconded, that the sum of

£10 per annum be placed at the disposal of the committee to aid a local effort being made for sending Philip Dunstan, of Constantine, and a person applied for by Miss Budge, of Camborne, to the Exeter Asylum for the Blind to learn an industrial employment. This concluded the business of the meeting.

Shortly before six o'clock, Mr. H. C. Salmon delivered a lecture "On the Origin of Crystalline Rocks," to an interested audience. (This lecture will be found in another portion of the report.) Afterwards, Mr. Blanchard, agent of the Lime Light Company, exhibited this newly-discovered light, the most powerful known, to a large assembly, and this terminated the proceedings of the first day.

SECOND DAY—THURSDAY.

At twelve o'clock this day, Dr. Barham, of Truro, took the chair on the platform in the hall, and said in the absence of the vice-presidents of the society, he had been asked to preside, and he did so merely for the purpose of enabling the secretary to give some further explanation respecting various objects in the room. He had himself only arrived that morning, and he had not had an opportunity of glancing even cursorily at a great many of the interesting objects that were exhibited; but he had seen enough to enable him to express a very decided opinion that on no former occasion, in all the various departments which were advanced by that institution, had there been a more favourable exhibition than the present. Although the number of objects exhibited might not be quite so great as on former occasions, yet in each class they reached a degree of excellence that had never been excelled. He would not detain them further, but merely ask the secretary to favour them with the explanations which he intended to offer.

Mr. Hodges then entered upon a long description of the various objects of interest in the Hall, most of which have been already referred to in the reports of the judges. After which

Mr. Hearder then said that he should endeavour, in compliance with the request that had been made, to give some description of Giffard's patent self-acting water injector, manufactured by Sharp, Steward and Co. He then proceeded to describe the machine, illustrating his remarks by sketching with chalk on a black board its leading parts, showing its principle to be simply the setting of a column of water contained in a tube in motion by a jet of steam from the boiler. A second tube connected with the same boiler from which the steam issued was so arranged that its orifice intercepted the column of water in its passage. The steam jet and the tube which was intended to resist the water and transmit it to the boiler, was furnished with a valve to prevent the escape of the water from the boiler by the pressure from within; and the orifice of the tube was placed so near to the jet of steam, that, both being under the same pressure, the momentum produced on the column of water by the action of the steam jet was just sufficient to overcome the pressure of the stop valve, and a portion of the water which was thus intercepted made its way past the valve into the boiler, into which it flowed in a constant stream. The quantity passing into the boiler was regulated by two screws, one of which adjusted the quantity of steam issuing through the jet, and the other the quantity of water permitted to flow through the water tube. He said that this description would explain the principle of the machine to those who were practically acquainted with steam power, and it was only for the benefit of those that the apparatus was invented. Mr. Hearder then entered upon a description of his inductometer, which will be found in another portion of the Report, after which Mr. R. Pearce, of the Miners' Association, explained Mr. Borlase's machine for separating metals and metallic ores. In order that they might more clearly understand the new invention, the model of which was exhibited in the centre of the hall, he described the mode at present adopted in mines of separating tin from the refuse with which it was mixed when the ore was brought from the mine, which consisted first of stamping, buddling, tossing and roasting. In the machine invented by Mr. Borlase, it would be seen that a peculiar jigging motion was given to a circular trough, into which the tin ore was washed after having been stamped, by means of which the rough stuff and fine tin were separated at the same time, and the refuse carried away in a state of solution, while the metal was left behind, thus effecting a great saving of time. He then read testimonials which Mr. Borlase had received from the agents of several mines, where the machine was used, including Drake Walls, Balleswidden, Boscean, Rosewarne, Herland, Carnyorth, and Allen's Head (lead) mines, in all of which the agents stated that the machine had answered satisfactorily. The expense of dressing lead ore by the machine, as compared with the old mode, was given in one of the last testimonials. The cost of the labour of the man and boy required to attend this machine was 4s. 3d., whereas by the old method the labour cost for the same quantity was 8s. 8d., thus effecting a saving of 4s. 5d. (The quantity of ore separated, or the time the men were employed, was not stated by Mr. Pearce.) In conclusion, he said that the plan appeared to be a good one, and he had no doubt that the machine would be generally adopted at the mines in the county.

At the suggestion of the Chairman, most of the company then adjourned to the committee room, where Mr. H. C. Salmon delivered an able lecture on the subject of Mineral Veins, which will be found *in extenso* elsewhere. At the conclusion, a short discussion took place, in which Mr. R. Grylls advanced some views partly in opposition to the lecturer. The Chairman then said—If no other gentleman has any remarks to make, it will be by my duty to thank Mr. Salmon for the interesting lecture he has given us. I should be very sorry if he had not drawn out some remarks with reference to his views. But, admitting the very great debateableness of a large number of the views broached in his lecture, there can be no doubt of the advantage to be derived from the presence amongst us of a gentleman richly furnished with science brought from other districts, who is independent of any local connection or local views, and who surveys the county from east to west, and compares the opinions prevalent in it with those formed by scientific and practical men in other parts of the world. I think it is a very great advantage to have such a gentleman as Mr. Salmon continuing his residence in this county, and giving his attention to such subjects as he has now laid before us. (Applause.)

MINING EDUCATION.

Dr. Barham then said—I would now refer to a subject which has been announced for discussion here; but the short time that remains to us forbids its being entered into in any detail whatever. That is the subject of mining education. I am also precluded, in some measure, from entering on it, or from giving any detailed information on the subject, by the absence of Mr. Hunt, which I am afraid is owing to his not being very well. I had hoped we should have him here to-day, and that he would have given us his opinion on one branch of the results of mining education—his examination, the other day of pupils at the St. Agnes Mining School,—the only branch of mining education at present going on in this county. The Polytechnic Society, in its corporate capacity, has not taken part in schemes for mining education; but still it is quite due to it to report here from time to time what is doing in that particular sphere. I will therefore briefly tell you what has been done since our meeting last year, when the subject was entered into in some detail. The scheme then proposed by the Royal Institution of Cornwall has been worked since, and I think very satisfactorily. Opinions have been gradually tending to something like unity, and the views of practical men have been more and more acceded to with reference to bringing home instruction to the doors of working miners. We have, in connection with our school, confined ourselves to the employment of our teacher, Mr. Pearce, who was formerly employed at Dolcoath, and is a son of one of the leading agents in that mine. We thought it would be desirable to give him an opportunity of bringing himself up to the latest advances in assaying and metallurgy generally, by letting him attend a term at the School of Mines, in Jermyn-street. That he did in the autumn of last year; and the statements of the professors under whom he worked, were highly creditable to his diligence and ability. On his return, we had a short course at Truro, of more advanced character, with regard to metallurgic chemistry; and, after that, a class was opened at St. Agnes, which may be said to be the most successful in its working, and in its immediate results, of any efforts that have been made in this county. The practical miners, and those above them, took the matter into their hands, and prepared the way for Mr. Pearce's instruction, by subscribing among themselves, and by forming an association of their own. Mr. Pearce subsequently visited them, and gave instruction for two months to a class of 27; and at the conclusion of that course, an examination was conducted by Mr. Hunt, by means of questions previously prepared, and embracing the elements of metallurgy and chemistry applicable to ores prevalent in this county. Mr. Hunt had reported on the results of that examination; and it would excite surprise, and cause much gratification among Cornish miners generally, to see how much real substantial knowledge had been acquired by those pupils—many of whom had no great advantage from previous education—in the course of so short a time. What appears to me particularly gratifying is, that on the conclusion of that course, the pupils, determined not to lose the seed sown in their soil, associated themselves, obtained funds, procured a room, and provided every requisite for carrying on a system of self-instruction, with occasional aid from Mr. Pearce, who will visit them once a fortnight. Mr. Pearce is about to renew a course of instruction at St. Just, where he attended last year, and where his instruction was highly appreciated. The St. Just people contributed handsomely to our funds, and also procured a handsome testimonial for Mr. Pearce, to show their sense of his services; and they are prepared to receive him again with open arms. What we are now about to do is this:—"We shall endeavour to form something like an amalgamation with the Miners' Association, inaugurated last year by Mr. Hunt, at a meeting at Camborne, over which Mr. St. Aubyn presided, and which, to all appearance, was very cordially received by the mining interest of the county. Our school is essentially based on the principle that the young must be instructed, not in a mere fanciful way, by attending a few lectures of a popular nature, but by actual working, as pupils would do in other schools, accustoming themselves to instruments and to investigations, and by repeated examinations, testing the progress they have made. With that instruction of the young, we shall endeavour to associate elder miners on some terms to which they may conform. A meeting will be held shortly at Redruth; and I do encourage the hope that anything like local jealousy may be abandoned; and that as those who may have been considered too theoretic by our miners are disposed to meet the practical men more than half way, so that practical men will concede something on their part to the higher and more scientific part of mining science.

The proceedings for the morning then terminated.

In the evening, the Hall was opened at the usual hour, but, in consequence of the unexpected departure of Mr. Hearder, no lecture was delivered. The Lime Light was exhibited, and Mr. Hodges repeated his description of the various objects of interest in the hall. Among the visitors to the exhibition this day were the poet laureate, Alfred Tennyson, and Mr. Holman Hunt.

On Friday, the hall was opened at the usual hour, and well filled with visitors. At two o'clock, Mr. Hodges again explained from the platform the various objects exhibited. In the evening, the Hall was thrown open principally for juveniles, and was completely thronged. Mr. Blanchard exhibited the lime light and some phantasmagorical effects with a magic lanthorn.

On Saturday, children and schools were admitted, and the working classes at the usual reduced rate. At about seven in the evening, the proceedings of the week terminated with Mr. Hodges' interesting lecture on "Many Things," which was delivered to a large and interested audience. This lecture will also be found in another portion of the report. The drawing of the Art Union was deferred until Monday, when it took place in the Hall, resulting in the following award of prizes:

H. M. St. Aubyn, Falmouth, photograph, 10s. E. Davies, Truro, £5. J. D. Freeman, Falmouth, £3. Mrs. Ivey, Helston, photograph, 10s. Lieut. Ives,

H.M.S. "Russell," £5. J. G. Chilcott, Truro, protograph, 10s. Mrs. Salmon, Truro, £1 10s. Miss Dobb, Truro, £25. W. J. Genn, Falmouth, photograph, 10s. Miss Fleet, photograph, 10s. S. R. Cater, Truro, photograph, 10s. Rev. T. Phillpotts, Porthgwidden, £15. John Michell, Redruth, £5. Mrs. Wodehouse, £5. Mr. Bickle, Hayle Foundry, photograph, 10s. N. Donnithorne, London, £7.

ON "MANY THINGS."

By Sydney Hodges.

Ladies and Gentlemen,—Standing before you as I do this evening, surrounded by the various objects of nature, art, and science, which are gathered together in this hall, I thought I could not do better than to call the few observations I am about to make, a lecture on "Many Things." It will be essentially polytechnic, and therefore an appropriate termination to this twenty-eighth exhibition of our society, which, like its predecessors, will after to-night be numbered among the things of the past, not, I trust, without leaving behind some pleasing reminiscences, some newly discovered facts, some profitable instruction, and some substantial benefits to our fellow creatures. During the past week the various objects in the hall have been more or less described in detail. This evening I shall, therefore, endeavour to group them together, not only in their outward aspect, but combining also those associations and far reaching interests which they so vividly suggest, coming as they do from places near at hand, and also from the most remote regions of the habitable world. Immediately before me, adjoining the fountain, is one of those inventions, the intention of which is to facilitate the great mining operations of the county and of the country. This machine of Mr. Borlase has obtained for him some very high testimonials from those best versed in the subject, which, together with the evident ingenuity of the machine itself, leads us to the conclusion that it is a great improvement on the old systems of separating ores which are in use in the county. The inventor may rest assured that, if really good, his system will prevail in spite of any obstacles or discouragements he may meet with in the outset, for what invention of any importance has not had its opponents from the time when Galileo was in chains to the prophecy of Sir Humphry Davy that London would be blown up with gas? We may express a hope that the opportunity which has here been afforded for bringing the machine more prominently before the public, will be as a helping hand to the inventor. In fact, I am informed that it has already been bespoken for the Wendron Consols Mine, where it is probable it will be tested, and its merits made known on a more extensive scale than we have the opportunity of exhibiting here. In glancing at the table beneath me, I see machines for facilitating operations in many branches of industry and science. The deep sea pressure gauge leads our thoughts away to those depths of the ocean, so vast as almost to overwhelm the imagination; and yet, to those vast depths man sends his little instruments down to solve a still unsettled problem of the scientific world, and by the simplest adjustment of a slide and index, the results are brought to the surface, marked as it were by an unerring hand. Again, we have an instrument which shows in a small compass the enormous power to be obtained by hydraulic pressure, whereby with a slight motion of the handle, a power equal to twenty tons weight may be obtained in a few strokes. In the portion of the model of Scheutz's calculating machine, we see one of the very highest results of the mathematician's skill, by which he has imparted to an inanimate machine the power of solving logarithms, and the most abstruse arithmetical calculations. Some idea of the enormous labour of constructing a machine of this kind may be drawn from the printed calculations cast off by the machine itself, which are on the table below. In the associations connected with this machine, one naturally recurs to those well known men who are found, few and far between, gifted with powers of calculation which suggest ideas of a distinct and superior faculty to that possessed by ordinary humanity. As an instance of this, I would mention Bidder, the civil engineer, who is, I believe, of Devonshire origin, and was known as the calculating boy. I was fortunate enough to be present at the Civil Engineers' Institution when Bidder read his paper, which afterwards became so popular, on his peculiar mode of calculation; and as an instance of the marvellous powers he possesses in this way, I may mention that he is is capable of adding up four columns of figures simultaneously, as we should one, and that he can without difficulty, multiply four figures into four figures as we should one by another; for instance as we should say 3 times 4 are 12, he would say, 2,867 times 1861 are 5,335,487. This result must be attained by a method of calculation which we cannot at all conceive, and yet Bidder tried to convince us that his rapidity of calculation was easily attainable by any one of ordinary intellect, if they went the right way to work. He said the three letters C O W do not represent to you three distinct objects, but one, a cow. "Now," he said, "the four figures 2 8 6 7 do not represent to me four distinct numbers, but one, viz., 2867. I have therefore no more difficulty in finding the result, than in saying 3 times 4 are 12. "To multiply four figures into four," he said "does not require much exertion of intellect, but I confess that there is some little difficulty in multiplying five into five." The late lamented Robert Stephenson presided on the occasion to which I refer, and I remember his rising at the conclusion of the lecture and saying that it was all very well for his friend Mr. Bidder, to state that he thought any one of ordinary capacity capable of acquiring the same power, but that he had had the pleasure of knowing him for the last thirty years, and he could state that on many occasions Mr. Bidder had in two or three hours arrived at results in difficult calculations which would have occupied himself and one or two assistants three or four weeks at least. By an easy transition while dwelling on these great men, Bidder and Stephenson, we may pass to the consideration of the invention of one who is now devoting his energies to the completion of a work which must be interesting to all in this town. I allude to Mr. Abernethy. He has kindly favoured us with some models of his method of erecting breakwaters, which appear to possess many advantages over other systems now in use. In anticipation, we may look forward to the time when perhaps an entire model of the completed works of our docks may find a place in this hall, or may perhaps indulge in a still brighter hope that, by the time that new era of prosperity shall have dawned on Falmouth, this hall may not be capable of containing the increased number of interesting and useful inventions that may swell our annual exhibitions, but that in one of enlarged dimensions, surrounded by multitudes of objects to which the present collection shall seem a mere fraction, we may hold these meetings, which for the last eight and twenty years have drawn together friends and acquaintances from the most distant parts of the county, and afforded an annual period of pleasure and instruction to numberless inquiring minds. We may, I think, fairly hope for these results, when we shall have obtained not only our docks but our railway—that link which is still wanting to unite us effectually with the progressive movements of this most astounding age—which has been so long promised, and for which we have waited with such long-enduring patience. We may, however, fairly console ourselves with the idea that it *must come*—that a populous port like this, with the enormous amount of shipping which yearly throngs our harbour, cannot, in the nature of things, be left very long behind the rest of the world in this respect; and with the facilities these improvements will afford us, combined with the beautiful Nature's harbour which God has given us, we may reasonably hope that Falmouth may attain a degree of prosperity second to none in the west of England. It is not we ourselves who are behind hand. I believe, and I know the feeling will be reciprocated by all who hear me, that the people of Falmouth are as enlightened and as ripe for the reception of the looked-for prosperity as those of any town in England. The existence of an institution like this which now draws us together—an institution which, not in our own opinion only, but in the opinion of all who visit it, is a pattern and an example to other counties, is a proof of what I assert. In spite of the disadvantages of locality, the remoteness from the metropolis, and the difficulty of access, Falmouth for nearly thirty years has maintained a society which is even yet in the prime of its existence; and which, I feel convinced, may in the future expand into a popularity which shall make it renowned throughout the length and breadth of the land. And why is it that this prosperity is maintained in all its vigour, when we find so many others about us suddenly terminating an ephemeral existence, or dwindling into an inanimate state which can scarcely be called life? It is because it is a Polytechnic Society—because it represents such multifarious and varied interest—because it does not confine its operations to one or two limited spheres of interest, but embraces every pursuit and every study, from the simple collection of birds' eggs in the case upon the table yonder, to the wonders of that machine and those mathematical results which have startled even the profoundest intellects of the age. In looking at the beautiful specimens of granite which adorn our hall on this occasion, it is a long way to wander back to those remote times when the Phœnicians visited our shores, to trade for the rich products of the mine which were even in those distant days brought to the surface. And yet the granite rocks from which these were hewn and shaped, existed on our hill-tops then, and in ages still more inconceivably remote. We have, however, in this hall some works of man which carry us back even to that distant time. Among a collection of coins upon the table near the largest vase, there is one of Epaminondas and another of Alexander the Great. Who shall venture to say that these were not manufactured thousands of years ago, from the metallic products of this very county? We know that Layard remarks upon a fact as strange—that some of those vast remains at Nineveh, the discovery of which rendered his name famous throughout the world, were in all probability composed of the metallic products of our Cornish hills, conveyed by the enterprising people before mentioned to the distant regions of the East. Then, in the lapse of ages, buried and lost in these distant deserts, and after an interval of 3,000 years again brought to light by a native of the very land from whence they were first conveyed, and more curious still, brought back again to that land to be deposited in its National Museum as records of the grandeur of those ancient people, and as enduring monuments of the ingenuity and enterprise of our own English race. This strange and startling connection of the past with the present, strikes us more forcibly with the discoveries of each succeeding year. Think of the wonders that first meet the eye as we draw near to that exquisite structure, the Crystal Palace of Sydenham! What is it we first see as we approach its shining front? not the marvellous erection itself, with its miles of glittering glass, its interminable wings, its lofty water towers, or its grandly arched transept? not the latest and most exquisite design of highly civilized man, but the huge, magnificent, yet terrible creatures, the gigantic elk, the mastodon, and other primeval monsters which wallowed in the desolate swamps and haunted the endless forests of the period which we call Chaos, restored by the hand of the magician science, to the very forms which they bore in those ages so inconceivably remote. In the immense strides which science has made, and is still making, the period of the Divine dispensation under which we of the present exist, seems overreached and reduced to a mere point in comparison with the interminable space of time over which our imaginations may now freely range. The celebrated Frenchman Adhemar, with a power of argument and research which it is difficult to set aside, attacks the theory of *one* universal deluge, and goes far to demonstrate the existence of *periodic* deluges, which, at long intervals of more than 10,000 years, devastate the entire globe, and possibly demand a new dispensation and a new creation of animate beings. I would not wish to startle those with whose theological views these theories may clash. It does not follow that they should in the least interfere the one with the other—10,000 years is a period amply sufficient for the creation, the fall, the redemption of man upon earth. Neither we, nor the inspired writers have absolutely to deal with the periods before or after. They had their mission to fulfil, and they fulfilled it with the light that was given to them. They wanted neither more nor less, they had their tasks in their appointed seasons, and they fulfilled them. Science was not their mission, and they passed it by; but if views such as those of Adhemar's are considered wild and improbable, let us remember that the very facts of science which we are now compelled to adopt, were at no very remote period sufficient to imperil the lives of their promulgators, and have absolutely consigned some to the dungeon. I grant that we should be cautious at first in admitting theories which appear wild and improbable, but when they are based upon the close calculations and incessant study of years, we should be equally cautious how we reject them on insufficient grounds. We must remember that in these latest days theories which seemed based upon an immoveable rock of science, such as Newton's system of gravitation, have at length met their opponents; that some have recently propounded the theory, and not by any means on weak or imaginary grounds, that it is repulsion, not attraction, which preserves the order of the universe. Others have had gleams of an entirely new law, which regulates the orbs of space; and I think no one, after the experience of the past, can venture to say that it is impossible that these gleams may not dawn into a brighter day than any the world has known before. It is hard, perhaps, to abandon our cherished theories, but it has been the experience of the last 4,000 years, and we cannot suppose ourselves exempt, with all our enlightenment, from the fallibility of those who have preceded us in the course of time. What does our own poet laureate say of this? He, whose vast intellect seems almost to have reached the verge of another and more enlightened creation! In referring to the facts of science and the utter incapacity of man to grasp the whole truth of the universe, he says—

> "Forerun thy time, thy peers, and let
> Thy feet *milleniums* hence be set
> In midst of knowledge *dreamed* not yet,
> Thou hast not gained a *real* height,
> Nor art thou nearer to the light,
> *Because the scale is infinite.*"

In these infinite and all-absorbing topics, however, I must not wander away from the main objects I have in view, to follow out the associations suggested by the leading objects in each department of our exhibition. Let me lead your thoughts for a few minutes to that interesting section of our exhibition—the Natural History tables. I said that our collection might carry our thoughts away to the far ends of the habitable world; but one specimen of that collection leads us to regions where civilised man has not penetrated; where, probably, arid plains deny the means of existence even to the meagre aborigines of the soil. I allude to the lyre bird, so called from the peculiar form taken by the feathers of the tail, representing an ancient lyre. This bird is rare even in its native land, and almost fabulous prices are given for specimens. Its rarity may be attributable to this fact, for naturally the pursuit of it is eager and constant, and only those of the quickest eye and strongest wing escape, thus, in this instance, confirming the idea of Darwin that the progressive developement of species may be in part due to the fact that those individuals of a species which possess the keenest energies survive, while the weaker ones meet an untimely end, and so by successive grades in the lapse of ages, the progress may be such as almost to make the latest individual of the species a distinct creature from one which existed ages on ages before. On that table also you have a very choice collection of lichens, collected, classified, and arranged with extreme care by one of the most diligent naturalists among the members of the society, one whose whole heart is in her work. How many beauties may be discovered in these lowest of all vegetable creations! Under the microscope especially they expand into beauties of form and colour which it is difficult to conceive until seen. And yet in what a marvellous manner do these neglected lichens soften down, mellow, and sometimes enrich the beauties of nature around us! What infinite form and colour on the bole of the ancient tree, on the stones of the mouldering wall, on the thatch of our cottage roofs! And to what kindly grandeur does this lowly creation rise in the golden splendour which sits enthroned upon the granite rocks of our mighty Cornish coast, shining like another sunlight on the highest peaks which look down for ever and ever in their sublime majesty upon the multitudinous breakers beneath. How marvellously may a simple object like one of these specimens, lead our thoughts upwards to the grandest scenes of nature! It is the result of the Divine chain—the golden chain with which God links his varied creations together, holding the end in His vast eternal hand, tha they and we among them may not be severed from him, whether in life, death, or eternity! On another table in the same section are some specimens of those lowly creatures of the animal kingdom, who had the misfortune to remain in obscurity during many ages of the world, and one morning within the last few years may be said to have awaked to find themselves famous. I allude to the *actiniæ*, collected and sent by the sister of the lady to whom I last referred, and whose collection I have never seen surpassed for cleanliness and the perfect health of the specimens. The noble hearted and large minded Kingsley, and their peculiar advocate, Mr. W. P. Gosse, have done much to bring these lowly creatures into fame. The latter by his varied and elaborate works on the subject, and the former by that enchanting little volume, which is probably familiar to many of you, entitled "Glaucus." There is a fascination about the pursuit of these creatúres, which it is difficult to imagine if it has never been tried. I have known the most inanimate among my male as well as female friends so infected by the mania, as to spring up into quite excitable creatures, and devote whole mornings to the pursuit; mornings which were previously passed in lolling on the sofa, or rolling on the grass with a cigar. Kingsley himself says in the introductory portions of his work, how much better it is for those who come to spend a few weeks at the watering places of the west, to devote themselves to some pursuit of this kind, instead of idling away, their time at *dejeuners* and evening parties composed of a *rechauffee* of third-rate London society. Never shall I forget the astonishment and delight I felt after my first hunt for Actiniæ. I don't mean my *very* first hunt, for that was when I was quite a boy, and the result was rather tragic as far as the zoophytes were concerned. I had secured some specimens of the common red *A. mesembryanthemum* and having taken them from a dry sunny rock which had been left by the tide, I thought to suit their habits and tastes by placing them in the full blaze of the sun on a window sill, until I procured a supply of fresh water for them, and by fresh, be it understood, I mean *not salt*. I thought nothing of the absence of the moisture which they retain beneath them on the rock, or of the already alarming heat of the window sill itself, or of the absence of the refluent tide, so that when I returned to my captives some half-an-hour after, I found only three blackened and shapeless masses, suggestive of nothing but that they were addicted to ardent spirits and had gone off by spontaneous combustion. My first real hunt, however, was suggested by the perusal of "Glaucus," and the next recurring spring tide, I went with a friend to explore those dark caverns and recesses of rock that occur in such wild beauty and variety in the vicinity of Dartmouth Harbour. There was at first something dreadful in penetrating into the mysterious recesses of broad-leaved slimy *Laminaria* which greeted us on every side, but presently, oh, joyful moment! I caught sight of an enormous *crassicornis*, and at once recognised him, from Kingsley's description. Presently another and another broke upon our astonished gaze; then in a little chink a lovely specimen of the *anguicoma*, so called from the delicate hair-like tentaculæ. Then a spotted mesembryanthemum, then a bright green *anthea*, all common enough now, but which then seemed to open a new world of delight and study to me. We grew wild with the excitement, plunged knee-deep into the slimy weed, boldly tackled the strong horns of the crassicornis, and in spite of the rain, which was pouring down in torrents, continued our pursuit until the returning tide drove us *nolentes volentes* from the sacred haunts we had so ruthlessly invaded. From that time for some years after, a new source of delight was ever open to me, and each returning spring tide was anticipated as eagerly as a holiday to a schoolboy. While residing at Glendurgan three years ago, my fancy reached its culminating point in an occurrence one evening which I shall ever remember. My friend (Mr. George Pender) and myself had been dwelling on the fact that these creatures were considered by the ancients rather a luxury, regarded gastronomically, and after perusing Gosse's somewhat elaborate description of his method of preparing them for table, we went to the kitchen and announced to cook our intention of supping on *fried crassicornis.* Cook at once decisively refused to undertake the task of cooking such stuff, and vacated the kitchen in disgust. Calling philosophy to our aid, however, we were determined not to be beaten, and therefore set to work ourselves, prepared some bread crumbs, broke our eggs, cleaned our actiniæ, and fried them in the egg and crumbs. They smelt savoury enough, and we brought them to table and devoured them. I don't mean to say we ever repeated the meal, although they were really not bad eating. In fact, they would be very good indeed, if it were not for a certain lump in the throat, which will rise up the moment you put the savoury morsel between your lips. There is not the least reason why they should not be eaten—they subsist on the purest of all nourishment, chiefly the salt water, and are therefore much more refined in their tastes and habits than our popular cannibalistic friends, the crab and lobster. There are some specimens in the pans yonder of one kind, *corynactis viridis*, which are finer than any I have before witnessed in collections of this kind, although I have very distinct remembrance of seeing some as fine on a favourite spot of mine at Newporth, where there is a huge rock nearly the width of this hall, upon which I have seen them in myriads, shining upon the perpendicular sides of the rock, like the stars of the binary systems in constellations of crimson, green, and gold. Here, too, I discovered the only specimens of the living madrepore, *caryophillia smithii*, which had, up to that time, been discovered between tide marks on this coast, although they had often been dredged from the bottom. Lately, however, the diligent collector of lichens before mentioned found some other specimens among the rocks under Pendennis. Crossing the room, and passing on our way, the interesting collection of curiosities from India, kindly forwarded by Capt. Tilly, and some others from China, contributed by Lieut. Robins, we come to the department of the exhibition devoted to Naval Architecture; and here the mind naturally recurs to the great fact in connection with this subject, which has been this year accomplished; namely, the safe voyage of the "Great Eastern" to and from the New World. The fact is a triumph of engineering and maritime skill, such as the world has never before known. What the result will be, it seems at present impossible to foresee. One thing is certain, that before we produce many such gigantic wanderers of the ocean, we must find ports for their safety, as at present their great danger appears to be proximity to the land. When the huge vessel was yet unlaunched and rearing her gigantic form in the yard of her enterprising projector, I happened to be present at a dinner, on the occasion of the presentation of the Manby testimonial, at the Ship Hotel, at Greenwich, and from the windows of the room, on the warm summer evening, we looked across the shining surface of the river to where the great ship was quietly reposing on the stocks. Stephenson, Brunel, and Scott Russell himself were present, the former presiding. Among the toasts, the health of Scott Russell was drunk, and in his reply he gave a lengthened and most interesting description of the rise and progress of this crowning triumph of marine architecture. The idea that first entered the heads of Brunel and himself was to construct a ship of sufficiently large dimensions to carry her coals all the way to Australia. Brunel went home full of the project and made his calculations accordingly, and on his re-appearance a few days after with them in his pocket, he was met by Russell with these words—"Brunel, we are all wrong; while we are about it, we must make her big enough to carry her coals all the way to Australia *and back*, and so avoid the enormous expense incurred in coaling at a foreign port." Brunel went home again, and the next time they met he had his calculation that she must be over six hundred feet in length, sixty in depth, and over 20,000 tons. "There has been an idea abroad, I learn," said Russell, "that Brunel and I laid our heads together for the simple intention of building a vessel larger than any that had ever existed before; but, from the calculations I have laid before you, you will see that she is the *smallest* vessel we could possibly have built capable of doing the work required of her. I have told you how the idea arose, and entered at some length into our plans, and there, gentlemen," he said, pointing across the river with his hand, "there is the result." Three of the great minds who were present on that occasion, and a rare occasion it was, containing within the space of one room almost the whole of those men of mechanical science whose works will stand through many coming years as records of their fame in every part of the civilised globe, three of them—Stephenson, Brunel, and Locke, have since passed away from among us. They have left monuments of their skill that have not been matched before in the annals of all time. One of them has linked our own county to the sister one by a work which overwhelms us with its stupendous daring, and although the cost to some has, I believe, been severe, we can scarcely regret it, when we reflect that this great triumph of engineering skill is as it were a part and portion of our own county of Cornwall. I glance my eye along the gallery above, and now, from the nature of my occupations, I seem to enter more particularly my own province. I have, however, dwelt so long on the associations with things below, that I must be as brief as possible with regard to the department of art above. During the last Polytechnic, I remember the news arrived of the discovery of the relics of the unfortunate Sir John Franklin and his ill-fated companions. The description of the discovery was read, I remember, from this very platform on the last evening, and now singularly enough, I have to call your attention to a picture recording an incident in the career of the ship in which he departed on his last fatal expedition. This picture has been referred to several times in the course of the week, and I do not know that I can say anything new about it, except, perhaps, it may not be generally known that the artist's soul was so thoroughly in his work, that, not contented with the sketch from which he drew his idea, he departed to the upper glaciers of the Alps, to study there the wonderful ice effects which are depicted so remarkably in the painting before us. It has the power of bringing home to us more vividly than any description the utter desolation of those ice-bound seas—the dreariness of the long winter months in regions such as these, fixed as if for ever in the midst of those enormous masses which no earthly power could sever, which need the Almighty hand to rend their immensities asunder, to release the captive ships. How everything in the picture tells the terrible story—the close housing of the decks, the sails still bent to the yards, overtaken probably by the frost and impossible to be moved, the distant party of hunters on the ice, and the bleached skeleton of the polar bear dangling from the yard arm. Let us pass from it to the genial sunny scene above, the sweetest of all our English home scenes—the hayfield—and from that to the charmingly imagined picture of Earl's—"The Dream of the Hound." Then again, the magic pencil of Boddington leads to a pleasant lane scene in Wales, where the brook trickling down among the rocks and flowers, reminds us of the graphic description of the poet—

I wind about, and in and out
  With here a blossom sailing;
And here and there a lusty trout,
  And here and there a grayling.

And here and there a foamy flake
  Upon me as I travel,
With many a silvery waterbreak,
  Above the golden gravel.

And draw them all along and flow
  To join the brimming river,
For men may come and men may go,
  But I go on for ever.

We may pay a passing tribute of respect and admiration to a painter, whose name is associated with our Cornish coast by his beautiful contributions to the water-colour exhibitions in Pall Mall. Mr. Cook, of Plymouth, to whom I refer, was taken from amongst us at a comparatively early age. He was always in a delicate state of health, but laboured on with a quiet devotion to his art until the last. One of his pictures adorns the side of our gallery; it is a view of Polperro, contributed by Dr. Drake, of St. Austell. This reference to great names in art naturally suggests the allusion to one of the very greatest, who has been within the last few days in our own neighbourhood—Mr. Holman Hunt, the painter of "The Light of the World," "The Scapegoat," and the "Finding of Christ in the Temple," which latter picture is this year exhibited in London, and daily drawing admiring crowds of spectators. Mr. Hunt is one of those patiently labouring Pre-Raphaelites, who devote years to the completion of one elaborate work. His picture of this year is the result of six years' labour, four of which were passed in Jerusalem. I went a few weeks since to see it; I must candidly confess, prepared to dislike it. His former pictures, although containing much originality of conception, evince such extravagancies of style and execution as to become in some instances quite repulsive. The first sight of "The Finding of Christ," however, made a convert of me, and I involuntarily felt myself in the presence of a work of art of which the world has scarcely seen the like before. I felt for a moment awed and overwhelmed, and mentally exclaimed that this, indeed, was the highest pinnacle of art. This feeling, however, subsides after a time. It is the marvellous, almost miraculous finish and elaboration of detail which thus strikes one at the first glance, combined with the extreme richness and beauty of colour. The representation of the gilded walls and pillars of the temple is so wrought out as to become almost an illusion—so perfect is the imitation, indeed, that the painter has been compelled to place a white margin round his picture, so that the real gilding of the frame may be distinctly separated from the fictitious gold in the picture. This fine work has, it is said, been sold to Gambart for the astounding sum (for a modern work) of £4,000. I had intended dwelling longer on the subject of art, but these ideas have necessarily been thrown so hastily together in the hurry of other matters, that I may say I have only just left my desk in time to appear before you as a lecturer. I must, however, say a few words of parting. In spite of the relief from incessant labour which the termination of this exhibition of course gives me, it is always with a feeling of melancholy that I find it drawing to a close. So many interests are awakened during its brief existence; so many faces of friends are seen from far distant places; so many new ideas implanted which one would wish to perpetuate, and which, in some cases, so soon pass from our minds when the exciting cause is withdrawn; and, withal, the old friends of the society seem to loiter amongst the many objects of interest with a lingering gaze, as if reluctant to look their last upon them, that one regrets the closing hour. This year, too, a warmer interest than usual seems to have filled the minds of all about us; the press has been louder in our praise, and I think in some respects deservedly so, for although there are some faults of omission and commission among the judges which must always happen unless men were angels and time eternity, yet they are few and far between, and I am happy to say that most of those who have awards are more than contented with them, and those who have not do not grumble. Your judges are but mortal, after all, aud they have a very inadequate space of time in which to fulfil their mortal tasks. I must say, from my inmost heart, I believe them, almost without an exception, to be thoroughly conscientious in the discharge of their laborious duties. An especial tribute of gratitude is due to Mr. J. J. Rogers for the really earnest way in which he performed his part in the work of the exhibition; to him and to Mr. Taylor it was no passing amusement, but downright hard work for two days at least. Your secretary is unhappily mortal also, and, labour as he will, he cannot make all things go straight among the multifarious duties on his hands at this time. It should be his part to look into, examine, and make himself master of every object in the hall; but this is impossible, when, as it often happens, many things come in on the very same day—sometimes even on the judges' day—sometimes even at the end of the exhibition—for one or two things only turned up yesterday, amongst them the explanation of the steam crane. We can only do our best, and, for my part, that shall be done; and I think I may answer for our judges and committee as well. I must not close without referring to the illustrious visitor who has been present on this occasion—the poet laureate, Alfred Tennyson. Of all the great names that have from time to time favoured us with their presence, scarcely one is more widely known to fame, or more deservedly so, than Alfred Tennyson. Who knows but in some future glorious poem he may not embody his remembrances of this meeting, as he did of the mechanics' festival described in "The Princess." Let us hope he will. I must now say farewell for another year. May we all meet again within these well-known walls. We may indulge in the hope; but death has been so busy around us of late, that we dare not dwell on the certainty. Let the hope, therefore, abide with us, remembering that

All is of God; if He but raise His hand,
  The mists collect, the rain falls thick and loud,
'Till, with a smile of light on sea and land,
  Lo! He looks back from the departing cloud.

Angels of life and death alike are His;
  Without His leave they cross no threshold o'er.
Who, then, would wish or dare, believing this,
  Against His messengers to shut the door?

On the Mortality of the Cornish Miners in the District of Marazion.

BY R. Q. COUCH, M.R.C.S., ESQ.

The next district to be examined, which comes within the area of my observation, is Marazion. It is very fertile, and admirably situated to ensure health and longevity. It lies on the south-eastern extremity of the peninsula forming the district of the Land's End, and embraces the town of Marazion, and the parishes of St. Hilary and Perranuthnoe. On its north-western side it is bounded by the low lands and marshy grounds of Ludgvan, and by the line of the West Cornwall Railway. On the south-west, it is washed by the waves of Mount's Bay. On the north-east and east it is bounded by the low and flat valley of the Hayle river, which passes below Tregembo, where one branch turns eastward and flanks the hill of Godolphin on the north, and the other runs to the south-east to Germoe, on to the granite.

Within this boundary there are no high hills or uncultivated swamps, but a general and moderate elevation. The only part that can have the least claim to the name of valley, is that through which the Hayle river runs. This, both above and below St. Erth, has two lake-like expansions of sandy mud, which, during the winter, is more or less covered with a shallow water. Higher up, in a south-eastern direction, the valley becomes deeper, and at Relubbas rises gently into the high hills of Godolphin and Tregonning; these are, however, beyond our district. On the west and north-west margin, there is the discoloured stream which empties itself into Mount's Bay at the Marazion Bridge. This stream arises from the swampy downs of Towednack, near Amalveor, and from the other and shorter vallies of Ludgvan. One or two small rivulets running to this stream also come from the interior of St. Hilary, passing through Plane-an-Guarry to the west. On the shores of Mount's

Bay there are only two or three rivulets—two at Prussia Cove, another below Acton Castle; but in a sanitary point of view these are of no importance, and serve only to mark short and unimportant valleys. On the west, the hills of Marazion rise suddenly to a small elevation out of the lowlands called the marsh. This occurs all along the line towards Hayle; but in the same direction the marsh itself gradually rises, by gentle undulations, into well cultivated fields. The valleys are shallow and fertile on the north, and only seem sterile where the mineral excavations disfigure the surface, as occurs about the Hayle river. Near the churchtown of St. Hilary there are numerous patches of woodland. The south part of this district is more varied in its character. Ascending by a gentle rise through the town of Marazion, you arrive at a low, sloping, meadow-like coast. The cliffs are low, and the bordering soil fertile, but more to the eastward the coast ground is barren, uncultivated, and much of it unenclosed; but this, again, changes for a sweep of very great fertility. The coast valleys, or creeks, are short, hilly, and much sheltered from the west, north, and east winds, and vegetation is early and luxuriant. The external influences affecting the climate are also favourable to health. In the north-west it is sheltered by the hills of Castle-an-Dinas and Trencrom, with their undulating sides sinking lower and lower, till, on a sandy and marshy bed, they reach the margin of the Marazion hills. On the east, the bleak winds are broken by Godolphin and Tregonning, which sweep downwards to the valley along the stream which runs through Relubbas. Portions of the ground on each side are wooded, and all parts are highly cultivated. On the south, there is the equalizing temperature of the sea. The only cold and blighting influence comes along the Hayle river, but this is much modified by the hill-sides of St. Erth and woods at Trewinnard.

In a district so cultivated, a large portion of the inhabitants must be engaged in agriculture, and such is the case. The farm houses are numerous, and cottages are, as it were, scattered broadcast everywhere. The chief situations for the houses, exclusive of Marazion, are Goldsithney, St. Hilary, and on each side of the lane and their bye-lanes on to Relubbas, Plane-an-Gwarry, Perranuthnoe, and along the Falmouth road. The villages are long and straggling, and the houses, though not large, are most of them well and substantially built. The internal accommodation, especially for sleeping room, is not so good as could be desired; yet, compared with the cottages of Lelant, Ludgvan and St. Just, they are very greatly in advance. There is an air of comfort, both within and without, for which we look in vain in the other districts. But even here the worst cottages are inhabited by the miners, though many miners live in the villages and have as good house accommodation as the district can supply. Goldsithney is one of the prettiest, cleanest, and most comfortable country villages I ever recollect to have seen.

The largest mass of the population resides at Marazion, a prettily situated borough, containing about 1,379 inhabitants. If we may judge of the prosperity of this district by its state of cultivation and the appearances of the cottages, it might be considered as highly satisfactory. But if the census of 1841 and of 1851 be compared, then it might be considered to be in a very unfavourable light. The population has considerably decreased; but the decrease has undoubtedly arisen from many of the mines having ceased working, and the miners having migrated into other districts, and into other countries. In Marazion, however, many of the best class of houses are also unoccupied; hence it may be supposed that the general prosperity of trade is also in a declining state. Some new houses are starting up here and there, with all the modern improvements, but they are not so numerous as those that are deserted, and the next census will, I fear, indicate a continuation of the same decline.

The population of the district in 1841 and 1851.

	1841.	1851.	Decrease.
Marazion..........	1,682	1,379	303
St. Hilary..........	1,804	1,642	162
Perranuthnoe......	1,588	1,229	359

Marazion is very healthfully situated. It lies along the south-western slope of a hill, opposite to St. Michael's Mount. It is sheltered from the north and north-east winds, but the general house accommodation is not good, and the streets are narrow, crooked and dirty. There is, however, in reality, only one long, straggling, and narrow street, the houses of which are low, and the rooms small and ill-ventilated. The passages to the other houses running at right angles to the chief street, are very narrow, and so arranged as to prevent the free circulation of air.

The whole of the district lies on the slate, or as it is locally called, "the killas"; but the beds are much distorted, and the dips are very varied. The chief disturbing influences have undoubtedly been the granite elevations of Godolphin and Tregonning hills; but beside these there are several extensive elvan dykes, having a general east and west direction, and one—a very large one—runs through the Marazion mines, to the north of the town, to Plane-an-Guarry, to the granite range, sending off a large branch at Plane-an-Gwarry, in a south-easterly direction, to Sidney cove. The mineral veins are numerous, and are generally in an east and west direction, but are much influenced by the elvan dykes, to the south. Trap rocks are common on the coast. Thus favourably situated for health, I will now examine the state of the mortality, and the diseases which produce it.

1837.

The record of this year extends from June to December, and during that period there were 39 deaths. Of these, 4 were miners, 21 males not miners, and 14 females.

Of the 4 miners—

3 died of consumption,
1 ,, pneumonia.

All died of thoracic diseases.

75 per cent. of consumption,
25 ,, pneumonia.

The oldest miner died of consumption, at 68; the youngest at 18, also of consumption. The average age of the miner, 47 years and 6 months.

Of the 21 males not miners, 10 died above five years old, and 11 died at and below 5.

Of the 11 who died at and below 5, 7 were the children of miners, and they died from pneumonia, consumption, hooping cough, and debility.

Of the 14 females, 10 died above 5, and four below. Of the 4 below, 2 were the children of miners, and died from debility and croup.

Of the adult males, 20 per cent died of consumption; one a farmer, the other a shopman.

Of the adult females, 30 per cent died of chest affections.

1838.

There were during the year 82 deaths. Of these, 12 were miners, 31 males not miners, and 39 females.

Of 12 miners—

66.66 per cent. died of consumption,
8.33 ,, pneumonia,
25.00 were killed.

Thus 74.99 per cent. died of diseases of the chest.

The oldest miner died at 70, of consumption; and the youngest at 16, also of consumption.

The average age of the miner, for the year, is 47 years and 4 months.

Of the 31 males not miners, 9 died above 5, and 22 at and below 5.

Of the 22 at and below 5—

13 were the children of miners,
2 ,, farmers,
2 ,, farm labourers,
1 was the child of a shoemaker,
4 were unknown.

The children of miners died of debility, pneumonia, croup, hooping cough, and hydrocephalus.

Of the 39 females, 24 died above 5 years of age, and 15 at and below 5.

Of the 15 below and at 5 years of age, 12 were the children of miners, and died from debility, croup, pneumonia, laryngismus, stridulus, and hooping cough.

Of the males, not miners, above 5, 22.22 per cent. died of thoracic diseases.

Of the females above 5, 20.83 per cent. died of chest affections.

This year was not visited by any epidemic of importance; a few cases of scarlet fever occurred, but not of a very fatal character.

1839.

There were during the year 99 deaths; and of these, 17 were miners, 31 males not miners, and 51 females.

Of the 17 miners—

58.80 per cent died of consumption,
5.88 ,, pneumonia,
5.88 ,, pleurisy,
11.76 were killed.

Of the miners, therefore, 70.56 per cent died from thoracic diseases. The oldest miner died at 83, of age and consumption; and the youngest was killed, at 15. The average age for the year is 42. The remainder of the miners died of dropsy, scarlet fever, and rupture of the bladder.

Of the 31 males not miners, above 5, 9 died; and of these 11.11 died of consumption.

Of the 51 females above 5, 27 died; and of these, 33.33 per cent. died of consumption.

Of the male children at and below 5, 2 died; and of these, 12 were the children of miners, dying of debility, hooping cough, and measles.

Of the female children at and below 5, 24 died; and of these, 26.08 per cent. died of debility, and 21.75 per cent. of measles, &c., and of these, 10 were the children of miners.

During the year, scarlet fever had all but disappeared; and, as it declined, measles appeared, with an occasional occurrence of small-pox.

1840.

There were 86 deaths during the year; of these, 11 were miners, 32 males not miners, and 43 females.

Of the 11 miners—

54.54 per cent. died of consumption,
9.09 „ palsy,
36.36 per cent. were killed.

The oldest miner died at 64, of consumption; the youngest was killed at 14. The average age for the year is 44 years and 5 months.

Of the 32 males not miners, 16 died above 5 years of age, and 16 below.

Of the 16 above 5—

25 per cent. died of consumption,
6.25 „ congestion of the lungs.

Of the 16 at and below 5, 7 were the children of miners, and

31.25 per cent. died of debility,
18.75 „ pneumonia.

Of the remainder, 12.50 per cent. from unknown causes; and spina bifida, fits, and hooping cough, were the chief of the recorded fatal diseases.

Of the 43 females, 27 died above 5, and 16 at and below 5.

Of the 27 above 5—

11.11 per cent. died of consumption,
3.70 „ pneumonia,
18.51 „ dropsy.

Of the 16 at and below 5, 12 were the children of miners;

62.50 per cent. died of debility,
6.25 „ pneumonia.

The remainder died of hooping cough, teething, thrush, and diarrhœa.

There was no epidemic for the year.

1841.

The deaths during the year are 125; of these, 27 are miners, 44 males not miners, and 54 females.

Of the 27 miners—

55.55 per cent. died of		consumption,
11.11	,,	pneumonia,
3.70	,,	pleurisy,
11.11 died suddenly,		
7.40 were killed.		

One died of small-pox, one of fever, and one of rheumatic fever.

The oldest miner died at 69, of consumption; the youngest of rheumatic fever, at 15. The average age of the miner for the year is 45 years and 8 months.

Of the 44 males not miners, 17 died above 5 years, and 27 at and below 5.

Of the 17 above 5—

41.17 per cent. died of		consumption,
5.88	,,	pneumonia,
5.88	,,	age,
11.76	,,	fever;

one died of stone in the bladder, one of palsy, and one of obstructions of the bowels.

1837 to 1841.

The record for 1837 is an imperfect one, inasmuch as it embraces only six months of the year, and, like all calculations on small numbers, is liable to excessive results. During the period embraced, the whole of the miners died of consumption and pneumonia; and thus, according to the plan pursued in these pages, that year would be returned as 100 per cent. dying of chest diseases.

The period of greatest mortality was in 1841. In that year 27 miners died, and chiefly of consumption and other chest affections; yet there was more disease of a general character than usual, and among the general population deaths were more than usually numerous. Small-pox prevailed in the early part of the year to June, and carried off 7 males and 3 females. Beside this, frequent cases of fever occurred, and several died. Sickly children died of debility and diseased lungs; and among the adults, various diseases of the chest. 1839 was the next in severity as it regards mortality, but it was 26 below 1841; the fatality lay chiefly among the females.

The greatest rate of mortality from chest diseases, excepting 1837, occurred in 1838; in that year 66.66 per cent. of miners died of consumption, and 8.33 per cent. of pneumonia. But this statement does not at all convey the true state of the case, for in that year all the miners who were not killed died of consumption and pneumonia. Excepting accidents, therefore, 100 per cent. died of diseased lungs, ; and in 1840, where the deaths among miners stand at 54.54 per cent. from consumption, if the deaths from accidents be deducted, and deaths arising from disease only be calculated on, then the mortality from consumption rises to 85.70 per cent. In 1841, where death from consumption is calculated at 55.55 per cent., from pneumonia at 11.11 per cent., and pleurisy at 3.70 per cent., if we again deduct accidents, death from consumption would rise to 60.00 per cent., from pneumonia to 12.00 per cent., and from pleurisy 4.00 per cent., and the whole would rise the ratio of deaths from thoracic disease up to 76.00 per cent. Then, instead of the average of the five years ending in 1841 being 72.17, which is, it must be confessed, alarmingly high, it would amount to 85.53 per cent. It is impossible to characterize such a result as an average of five years. The figures in the following table, high as they are, therefore, do not really indicate the great predominancy of consumption over every other disease attacking the mining population.

But the average of the 5 years among miners, when compared with the averages for the same period among non-mining males and females, is so very excessive, that it ought to excite the utmost interest, and stimulate us to every effort to remove or lessen so frightful a scourge. It is about 2¼ times as great in miners as in non-mining males.

A Table shewing the ratio of chest affections from 1837 to 1841.

Names.	1837.	1838.	1839.	1840.	1841.	Average.
Miners.	Con. 75.00 Pneu. 25.00	66.66 8.33	58.80 5.88	54.54	55.55 11.11	72.17
Males Non Mining.	Con. 20.00 Pneu.	22.22	11.11	25.00 6.25	47.17 5.88	26.82
Females.	Con. 30.00 Pneu.	20.83	33.33	11.11 3.70	38.46 11.52	29.79

1842.

The number of deaths for the year is 108; of these, 16 were miners, 32 males not miners, and 60 females.

Of the 16 miners—

56.25 per cent. died of consumption,
18.75 „ were killed.

Of the remainder, one died of erysipelas, after an injury, one died of phlegmonous inflammation of the arm, after a bruise, one died of dropsy, and one of diseased stomach.

The oldest miner died at 78, of consumption; the youngest of consumption, at 14. The average age for the year is 48 years and 11 months.

Of the males not miners, 10 died above 5, and 22 at and below 5 years of age.

Of the 10 above 5—

40.00 per cent. died of consumption,
10.00 „ pneumonia.

Of the 22 at and under 5, 16 were the children of miners.

36.36 per cent died of debility,
13.62 „ pneumonia,
9.09 „ diseased lungs,
the character of which is not recorded.

Of the 60 females, 30 died above 5, and 30 at and below 5 years of age.

Of the 30 above 5—

40.52 per cent. died of consumption,

10.00 per cent. died of cancer of the womb,
6.66 „ puerperal fever.

Of the 30 female children at and below 5, 24 were the children of miners.

26.66 per cent. died of debility,
6.66 „ croup,
10.00 „ diseased lungs, not described.
3.33 „ consumption,
13.33 „ pneumouia.

1843.

The deaths during the year were 97; of these, 8 were miners, 42 males not miners, and 47 females.

Of the 8 miners—

87.50 per cent. died of consumption,
12.50 „ pleurisy.

The oldest miner died at 68, of consumption, the youngest at 31, of consumption. The average age for the year is 49 years and 9 months.

Of the 42 males not miners, 10 died above 5 years of age, and 32 at and below 5.

Of the 10 above 5—

30.00 per cent. died of consumption,
20.00 „ erysipelas.

Of the 32 at and below five, 20 were the children of miners.

12.50 per cent. died of debility.
18.75 „ scarlet fever,
9.67 „ hydroceph,
12.50 „ disease of the lungs, not specified.
6.25 „ pneumonia,
3.12 „ asthma.

Of the 47 females, 29 died above 5, and 18 at and below 5.

Of the 29 females—

17.24 per cent. died of consumption,
3.46 „ pleurisy,

6.92 per cent. died of influenza.

Of the 18 at and below 5, 14 were the children of miners.

55.55 per cent. died of scarlet fever,
16.66 ,, debility.
11.11 ,, diseased lungs.

Scarlet fever prevailed as an epidemic, and was fatal in 6 cases of male, and 10 of female children.

1844.

The number of deaths during the year is 123; of these, 18 are miners, 48 males not miners, and 57 females.

Of the 18 miners—

50.00 per cent. died of consumption,
11.11 ,, pneumonia,
5.55 ,, pleurisy,
16.16 ,, accident.

The remainder died of diseased liver and fever. The oldest miner at 62, of consumption; the youngest of consumption, at 16. The average age for the year is 36 years and 6 months.

Of the 48 males not miners, 21 died above 5, and 28 at and below 5.

Of the 21 above 5—

23.80 per cent. died of consumption,
9.52 ., pneumonia,
4.76 ,, asthma,
14.28 ,, hydrocephalus.

Of the 27 below 5 years of age, 8 were the children of miners

Of the 27 below 5—

29.63 per cent. died of debility,
18.50 ,, scarlet fever,
7.40 ,, hydrocephalus,
7.40 ,, pneumonia.

Of the 57 females, 26 died above 5, and 31 at and below 5.

Of the 26 above 5—

30.76 per cent. died of consumption,
3.84 ,, pneumonia.

Of the 31 at and below 5, 21 were the children of miners.

Of the 31—

22.58	per cent. died of	debility,
25.80	,,	hooping cough,
3.22	,,	pneumonia,
3.22	,,	convulsions,
3.22	,,	measles.

1845.

There died during the year 109; of these, 10 were miners, 43 males not miners, and 56 females.

Of the 10 miners—

20.00	per cent. died of	consumption,
30.00	,,	pneumonia,
20.00	,,	hepatitis,
10.00	,,	diseased heart,

and one of palsy, and one of enteritis. The oldest miner died of enteritis, at 71; and the youngest of pneumonia, at 24. The average age for the year is 53 years and 7 months.

Of the male population not miners, 21 died above 5 years of age, and 22 at and below 5.

Of the males 21 above 5—

33.33	per cent. died of	consumption,
9.52	,,	pneumonia,
4.76	,,	asthma.

Of the 22 males at and below 5, 18 were the children of miners.

Of the 22—

40.90	per cent. died of	debility,
13.63	,,	pneumonia,
9.09	,,	laryngitis,
13.63	,,	suddenly.

Of the 56 females, 28 died above 5, and 28 at and below 5.

Of the 28 above 5—

28.57	per cent died of	consumption,
7.14	,,	palsy.

Of the 28 at and below 5, 16 were the children of miners.

Of the 28—

39.28 per cent. died of		debility,
2.57	,,	consumption,
7.14	,,	hydrocephalus,
14.28	,,	fits.

The great mortality this year arose from diseases of the chest in the non-mining population of adult age, and from debility among children.

1846.

There died during the year 88; of these, 19 were miners, 31 males not miners, and 38 females.

Of the 19 miners—

73.68 per cent. died of		consumption,
10.52	,,	pneumonia,
10.52	,,	diseased heart,

and one from accident. The oldest miner died of diseased heart, at 72; and the youngest was killed at 13. The average age is 52 years and 7 months.

Of the 31 non-mining males, 16 died above 5, and 15 at and below 5.

Of the 16 above 5—

6.25 per cent. died of		consumption,
6.25	,,	pneumonia,
6.25	,,	pleurisy,

and the remainder died of epilepsy, palsy, hernia, diseased liver, &c.

Of the 15 at and below 5, 7 were the children of miners.

Of the 15—

53.00 per cent. died of		debility,
20.00	,,	fits,
13.13	,,	laryngitis.

Of the 38 females, 26 died above 5, and 12 at and below 5 years of age.

Of the 26 adults—

15.38 per cent. died of consumption,

31.25 per cent. died of pneumonia,
6.25 ,, pleurisy.

Of the 12 at and below 5, 9 were the children of miners.

Of the 12—

48.66 per cent. died of debility,
25.00 ,, pneumonia,
8.33 ,, laryngitis.

The average mortality of all classes, for the last five years, has been 101 per annum. The highest rate occurred in 1844, when hooping cough prevailed as an epidemic, and when no less than 15 children died of "debility" alone. A few cases of scarlet fever occurred, as well as measles; and, as the season was a very cold and chilly one, the hooping cough was very severe, and chest affections prevailed. Towards Christmas, when the cold weather set in, many old persons, who had previously been suffering from influenza, died—no less than 11 females dying between 75 and 90, and 6 males between 70 and 81; and 18 miners died—50.00 per cent. from consumption, and 11 per cent. from pneumonia. The two years of greatest general mortality were 1844 and 1845; but in 1846, when the general mortality was at its minimum, the mortality of miners was at its maximum, and chiefly from diseases of the chest; and in 1843, at its minimum, and then entirely from diseases of the chest. The maximum mortality among females was in 1842, next in 1844 and 1845, when they may be said to have been equal, and its minimum in 1846, when the miners' was at its highest. The maximum of the death rate among the general males was in 1844, when the rate among the miners was also very high. The mortality among miners, as well as among the general population, from chest diseases, seems to be in the extreme, being either very high or very low when compared with other districts; but the average of the five years, in the case of the miners, is very high, which, considering the salubrity of the climate, is very remarkable, and will require further consideration. In 1845, the death rate of miners was 20.00 per cent. of consumption, and 30.00 per cent. of pneumonia, but in 1843 it was 87.50 per cent. of consumption and 12.00 per cent. of pleurisy, being in reality all the deaths that occurred. Yet in 1846 it amounted to 84.20 per cent., and the average of the 5 years is 67.81 per cent.—a rate which, under any circumstances, is really appalling. But the subjoined table will show the relative occurrence of chest diseases in the whole of the population above 5 years of age.

Table showing the rate of mortality from thoracic diseases, in all classes, from 1842 to 1846.

Names.	1842.	1843.	1844.	1845.	1846.	Average.
Miners.	Con. 56.25 Pneu.	87.50	50.00 11.11	20.00 30.00	73.68 10.52	67.81
Males Not Miners.	Con. 40.00 Pneu. 10.00	30.00	23.80 9.52	33.33 9.04	6.25 6.25	33.53
Females.	Con. 40.52 Pneu.	17.24	30.76 3.84	28.57	15.38 19.25	33.51

From this table, it again becomes manifest that the death rate among miners, from chest affections, is greatly above that of non-mining males, being about double.

The average of the five years is taken from consumption and pneumonia alone, and among the miners it amounts to 67.81 per cent.; but if pleurisy, &c., had been included, it would have arisen to 71.42 per cent. And among the females, the average from consumption and pneumonia amounts to 33.51; would have risen to 34.36 per cent. by the addition of pleurisy. But, view the results as we will, two very important circumstances become apparent. That the death rate from chest diseases among miners is double that of the non-mining males, and more than double that of females, although the two latter classes have the disadvantage of being calculated from five years of age, whereas the miners is from ten.

There seems to be no constancy in the occurrence of other diseases, which might have given rise to the supposition of their dependence on mining operations. There is occasional dropsy in connection both with diseased heart and diseased liver, as well as palsy; and when they occur, they are, no doubt, much aggravated by the climbing the ladders and the use of the hammers and borers underground. In fact, it seems remarkable that diseased heart is not more frequently registered as a cause of death than it is; but it may arise from a greater tendency to diseased lungs proving more rapidly injurious than diseased heart, and hence the men die out before it has time to develope itself. The accidents recorded during this period of five years are not numerous. In the years 1843 and 1845 there were none; but in 1842 there were three between the ages of 17 and 21; in 1844, there were three, at 20, 22, and 42; and in 1846, there was one, at 13. Those at 42 and 21 were killed by materials falling on them; others were killed by falling from a height, such as down the ladders. The average age of the whole of those killed is 22; but the average age of those killed by falling is 18. In either case, it appears that accidents most frequently occur to the young, but the falling of materials on the men will occur to men of all ages; but death arising from the men themselves falling, or being injured by machinery, occurs almost always to the very young. Hence I am inclined to think that many accidents must arise from the carelessness and thoughtlessness of youth, and might be prevented by some severe enactments tending to suppress the excess of daring so common to youth. But the accidents recorded are fatal ones only; but many others, less serious in character, are of constant occurrence. Some are only bruises and injuries of a trifling character. Others though not fatal, are such as to prevent any future occupation in mining operations. The register, therefore, cannot be considered as at all representing the frequency of accidents. The most serious of the non-fatal accidents arise from blasting, and these most commonly occur from the neglect of recommended caution —the wilful perseverance in the employment of metallic instead of wooden tamping rods. On this subject, the adventurers are constant in their endeavours to induce the men to use the wooden rods, and the agents are equally solicitous on the subject, but without effect. And the next frequent cause of accident is, that if a lode misses fire at the time anticipated, the men may, perhaps, be induced to wait a few minutes beyond the time, but a few minutes only, and forward they go to ascertain the cause of their failure, and then the explosions take place, and much injury is done both to eyes and limbs. I have, at this moment, four men under treatment from this cause alone; two will probably lose their sight, and one will lose his right hand. But much of the consequences of this evil might be remedied if we had hospital accommodation sufficient for constant attention; and careful nursing, would have restored many who now suffer from loss of sight. But the men live so far apart, and are separated by such barren wastes, that the time occupied in visiting is so great as to preclude the possibility of their having so much care as would most willingly be bestowed on them.

1847.

The number of deaths during the year is 92; of these, 16 were miners, 29 males not miners, and 47 females.

Of the 16 miners—

62.50 per cent. died of consumption,
6.25 ,, pneumonia,
12.50 ,, were killed.

The remainder died of jaundice, diseased brain, and suppression of urine.

The oldest miner died at 72, of suppression of urine; and the youngest was killed, at 18. The average age for the year is 44 years and 1 month.

Of the 29 males not miners, 15 died above 5 years of age, and 14 at and below 5.

Of the 15 above 5—

6.66 per cent died of consumption,
6.66 ,, pneumonia.

Of the 14 at and below 5—

21.42 per cent. died of pneumonia,
42.85 ,, debility,
7.14 ,, tabes.

Of these 14 children, 7 were offspring of miners.

10.00 per cent. died of asthma,

10.00 „ pulmonary apoplexy.

Of the remainder, two died of palsy, one of dysentery, and one of meningitis.

The youngest miner died of meningitis, at 18; the oldest at 78, of asthma. There were two others well advanced in age, one at 75, dying of palsy, and another of pneumonia, at 73. The average age for the year is 50 years and 7 months.

Of the 44 non-mining males, 19 died above 5 years of age.

21.05 per cent. died of consumption,

10.52 „ pneumonia,

and 21 per cent. died of age.

Of the remainder at and below 5—

16.00 per cent. died of scrofula,

4.00 „ pneumonia.

Of the remaining children, 40.00 per cent. died of small-pox, and 32.00 per cent. died of debility.

Of the 48 females, 29 died above 5 years of age, and of these—

20.62 per cent. died of consumption,

17.24 „ age.

Of the remainder, 19 died at and below 5, and of these—

15.78 per cent. died of consumption.

During this year small-pox prevailed, and 16 males and females died of it below 5 years old, and 14 died of debility.

Of the 25 male children, 12 were the children of miners; and of the 19 female children, 13 were the children of miners.

1851.

The number of deaths for the year is 86; of these, 14 were miners, 30 males not miners, and 42 females.

Of the 14 miners—

50.00 per cent. died of consumption,

7.14 „ pneumouia.

7.14 „ pleurisy,

7.14 „ pulmonary apoplexy,

7.14 „ bronchitis.

Of the remainder, one died of tuberculous disease of the liver, one of meningitis, and one of apoplexy.

The youngest miner died at 15, of pneumonia; the oldest of meningitis, at 59. The average age for the year is 41 years and 4 months.

Of the 30 males, not miners, 17 died above 5 years of age, and 13 at and below 5.

Of the 17 above 5—

23.52	per cent. died of	consumption,
11.76	„	pneumonia.

Of the 13 at and below 5—

23.07	per cent. died of	pneumonia,
61.53	„	debility.

Of these 13, 8 were the children of miners.

Of the 42 females, 30 died above 5, and 12 at and below 5 years of age.

Of the 30 above 5 years of age—

16.66	per cent. died of	consumption,
6.66	„	pneumonia,
6.66	„	pulmonary apoplexy.

Of the 12 below 5—

41.16	per cent. died of	debility,
16.66	„	pneumonia.

Of these 12, 10 were the children of miners.

The period of greatest mortality during the last five years, is 1850, when 102 died; but during that year small-pox prevailed, and was fatal among the adults as well as children. Among children, 16 died, and 5 among the adults; deducting these from the amount, the year was about an average one. The year 1849 was a remarkably healthy one, as it regards the general population.

The greatest number of miners died in 1848, and 84 per cent. of these died of consumption. In 1849, the year of least mortality among miners, 55.55 per cent. died of consumption. In 1850, the year of greatest general mortality, the mortality among miners was only one above 1849; and during that year, the mortality from consumption among miners was 20.00 per cent., 20.00 per cent. sinking from pneumonia, and 10.00 per cent. from pulmonary apoplexy. After 1848, the year of greatest death rate among miners, 1847 comes next highest, and during that year, 62.50 per cent. sank from consumption, and 6.25 per cent. from pneumonia.

Among the non-mining males, the greatest number of consumptive deaths occurred in 1849, and next in 1848, and so also among the females. But the year 1850 had the greatest general mortality among the general male population; among the females, 1850 and 1848 were equally the greatest years of fatality; the latter of which was the most fatal also for miners and for the prevalence of consumption; and in fact, if we omit the epidemic small-pox from our consideration, the year 1848 was decidedly the year of greatest death rate for the period; but during this year, there was no special malady of a serious character prevailing. The mortality arose from the general inclemency of the year.

A table shewing the mortality from chest diseases from 1847 to 1851.

Names.	1847.	1848.	1849.	1850.	1851.	Average.
Miners.	Con. 62.50 Pneu. 6.25	84.21	55.55	20.00 20.00	50.00 7.14	61.20
Males, not Miners, above 5 years.	Con. 6.66 Pneu. 6.66	35.71	37.50	21.05 10.52	23.52 11.76	30.65
Females, above 5 years.	Con. 11.11 Pneu. 3.70	22.22	26.31 5.26	20.62	16.66 6.66	22.50

From this table it again appears, that however individual years may differ from each other, and however wide that difference may be, yet that in any given number, there is a general average of approximation. In the present period, the mortality of males of the general population is only one half that of miners from chest diseases; and compared with females, the death rate of miners from the same cause, is not quite three times that of the females.

The number of accidents is but small, but they indicate the same thing, the early age of those meeting with them. In 1847, there were two at the ages of 13 and 14; in 1848, one at 15; and in 1849, one at 16.

The mortality among children is also great at a very early age, thus in 1847, 42 per cent. of the male children, and 60 per cent. of female children, died of debility; in 1848, 50.00 per cent. of males, and 47 per cent. of female children died of the same state of constitution.

	Male children.		Female children.	
In 1849,	61.53 per cent.	and	72.72 per cent.	died of debility.
,, 1850,	32.00	,,	31.57	,,
,, 1851,	61.53	,,	41.66	,,

We see by this that of all children dying below 5 years of age, how many die of mere constitutional debility, and most commonly within the first year of their existence. This calculation is not based on the whole mortality of males and females, but on the deaths of persons dying below 5; of these, the per centages from debility are closely calculated.

1852.

The number of deaths for the year is 108; of these, 12 were miners, 49 males not miners, and 47 females.

Of the 12 miners—

66.66 per cent. died of consumption,
8.33 ,, hœmoptisis.

Of the remainder, one died of age, at 88; one of dropsy, and one of apoplexy. The one dying of age had for more than 20 years ceased following his occupation, and had for 15 years previously worked entirely at the surface. The one who died of apoplexy had also for many years not followed mining; but the particulars concerning him I could not minutely ascertain.

The oldest miner died of age, at 88; the youngest at 14, of dropsy. The average age for the year is 55 years and 2 months.

Of the 49 males not miners, 24 died above 5 years of age, and 25 at and below 5.

Of the 24 above 5—

16.66 per cent. died of consumption,
8.33 „ pneumonia,

Of the 25 at and below 5—

36.00 per cent. died of debility,
8.00 „ consumption.

Of the 47 females, 33 died above 5 years of age, and 14 below.

Of the 33 above 5—

27.27 per cent. died of consumption,
3.03 „ pulmonary apoplexy.

Of the 14 at and below 5—

14.28 per cent. died of pneumonia,
28.57 „ debility.

During this year scarlet fever prevailed, and carried off 8 children and 5 adults.

Of the 25 males below 5, 21 were the sons of miners.

Of the 14 females below 5, 7 were the children of miners.

1853.

The number of deaths for the year is 98; of these, 13 were miners, 37 males not miners, and 48 females.

Of the 13 miners—

46.15 per cent. died of consumption,
7.69 „ pneumonia,
7.69 „ hœmoptisis.

Of the remainder, one died of scarlet fever, one of meningitis, two of diseased kidney, *(morbus brightii)* and one of hernia.

The oldest miner died of Bright's disease, at 68; the youngest 2 at 21, of consumption and meningitis; and the average age for the year is 44 years and 6 months.

Of the 37 non-mining males, 13 died above 5 years of age, and 24 at and below 5.

Of the 13 above 5—

30.76 per cent. died of consumption,
7.69 „ pneumonia.

Of the 24 at and below 5—

4.16 per cent. died of consumption,
20.83 „ pneumonia,
33.33 „ debility.

Of the 27 females above 5—

44.44 per cent. died of consumption.

Of the 21 at and below 5—

42.85 per cent. died of debility,
9.04 „ pneumonia.

No epidemic occurred during the year. Among the adult males, the chief mortality arose from consumption; among the females, from consumption and age; and among children, from debility and pneumonia.

1854.

The number dying during the year is 102; of these, 20 were miners, 38 males non-miners, and 44 females.

Of the 20 miners—

20.00 per cent. died of consumption,
10.00 „ pneumonia,
10.00 „ heart disease,
25.00 „ were killed.

Of the remainder, one died of dysuria, one of palsy, one of ulceration of the stomach, one of stricture of the pylorus, one of cancer of the jaw, one of ileus, and one of dropsy.

The oldest miner died at 83, of dysuria; the youngest was killed at 11. The average age for the year is 46 years and 6 months.

Of the 38 non-mining males, 17 died above 5, and 21 at and below 5.

Of the 17 above 5—

47.05 per cent. died of consumption,
5.88 „ pleurisy.

Of the 21 at and below 5—

33.33 per cent. died of debility,
9.52 „ pneumonia.

Of the 44 females, 22 died above 5, and 22 at and below 5.

Of the 22 above 5—

9.09 per cent. died of consumption.

Of the 22 at and below 5—

40.90 per cent. died of debility.

Of the 21 male children, 14 were the children of miners, and 7 died of debility.

Of the 22 female children, 7 were the children of miners, and 4 died of debility.

Measles prevailed as an epidemic, but was not very fatal—five children died of it in the early part of the year. In May, June, and July, scarlet fever made its appearance, and the measles disappeared, and 6 died of it.

1855.

The number of deaths for the year was 90; of these, 12 were miners, 33 males not miners, and 45 females.

Of the 12 miners—

50.00 per cent. died of consumption,
8.33 ,, pleurisy.

Of the remainder, one died of age, one of peritonitis, one of cirrhosis, one of diseased heart, and one was killed. The oldest miner died of age, at 79; and the youngest at 23, of heart disease. The average age for the year is 48 years and 1 month.

Of the 33 non-mining males, 15 died above 5, and 18 at and below 5.

Of the 15 above 5—

33.33 per cent. died of consumption,
6.66 ,, pneumonia,
6.66 ,, hœmoptisis.

Of the 18 at and below 5—

5.55 per cent. died of consumption,
3.33 ,, debility.

Of the 45 females, 26 died above 5, and 19 at and below 5.

Of the 26 above 5—

19.23 per cent. died of consumption,
3.84 ,, pneumonia.

Of the 19 at and below 5—

63.15 per cent. died of debility,
10.52 „ pneumonia.

Of the 18 male children, 12 were the children of miners, a n 5 died of debility.

Of the 19 female children, 6 were the children of miners, and 4 died of debility.

In the summer, scarlet fever prevailed as an epidemic, and 6 children died of it.

1856.

The number of deaths for the year is 103; of these, 10 were miners, 38 males not miners, and 55 females.

Of the 10 miners—

40.00 per cent. died of consumption,
30.00 „ pneumonia.

Of the remainder, one died of hepatitis, one of softening of the brain, and one of diseased bladder. The oldest died at 75, of diseased brain; and the youngest at 21, of consumption. The average age for the year is 55 years and 4 months.

Of the 38 non-mining males, 18 died above 5, and 20 at and below 5.

Of the 18 above 5—

22.22 per cent. died of consumption,
5.55 „ bronchitis.

Of the 20 below 5—

5.00 per cent. died of consumption,
35.00 „ debility,
10.00 „ scarlet fever,
15.00 „ measles.

Of the 55 females, 34 died above 5, and 21 at and below 5.

Of the 34 females above 5—

23.52 per cent. died of consumption,
5.88 „ pneumonia.

Of the 21 at and below 5—

23.85 per cent died of pneumonia,

33.33 „ debility.

Scarlet fever and measles occurred as epidemics during the year, 8 males and 13 females dying from the former, and 3 males and 2 females from the latter.

The year was very generally an unhealthy one. The annual number of deaths has not varied much. The highest total of all classes ocurred in 1852; the next, in 1856 and 1854; and the least in 1855. The greatest mortality among miners took place in 1854, the year of least mortality among females, and not the highest among the general males. The mortality, though so great among miners in 1854, showed, however, the smallest amount of chest diseases. During this year 5 were killed, and more died from a variety of diseases than usual. The year of greatest mortality (1852) had the average number of miners, and during that year 66.66 per cent. died of consumption, and one of hemorrhage from the lungs, in which extensive tubercular disease had developed itself; so that, in this year, the real per centage is 74.99; and in 1853 there is also recorded a death from hemorrhage. In both these cases death immediately followed the discharge of blood; but in each, there previously existed tubercular disease, and they might, therefore, be included in our consumptive returns, but are not.

A table showing the mortality from chest diseases from 1852 to 1856, inclusive.

Names.	1852.	1853.	1854.	1855.	1856.	Average.
Miners.	Con. 66.66 Pneu. 8.33	46.15 7.69	20.00 10.00	50.00	40.00 30.00	55.76
Males Not Miners, above 5	Con. 16.66 Pneu. 8.33	30.76 7.69	47.05	33.33	22.22	34.74
Females above five.	Con. 27.27 Pneu. 3.03	44.44	9.09	19.23 3.84	23.52 5.88	27.26

From this table it is at once evident that during the last five years the number of deaths arising from consumption among the miners has neither been so high nor so low as in any previous period; but yet it is considerably higher than for the same period in St. Just, and it is slightly higher than occurs in St. Ives and Lelant. But, notwithstanding this, the mortality among miners from chest affections is nearly double that among females, and not far from double that of the male population. This result is, therefore, not the mere accident of a single period, but of twenty years; and that not of the district now under examination only, but also of St. Just, Lelant, and St. Ives, offering a great variety of positions and local influences which must have modified the subject, if the result had been merely accidental. In St. Buryan, where farmers and farm labourers are the chief inhabitants, and which correspond, so far as position in life is concerned, with the miners, the result is very striking. The cases of consumption and other chest affections of a fatal character are of comparatively rare occurrence. From this it is but fair to conclude that this great mortality from one class of disease, in a particular occupation, must arise from the nature of that occupation. And as so many men are engaged in it, and so much wealth is embarked in mining, it becomes a matter of great importance in a sanitary point of view, as well as of commercial speculation, whether some remedy cannot be applied. The next subject for inquiry will be under what conditions is the tendency to consumption developed, and under what circumstances is the tendency accelerated or retarded, and then it will be a fair question to ask whether our mines cannot be rendered more healthy than they are at present. During this last period of five years, there have been six deaths from accident; one in 1855, at 44, and five in 1854, at the ages of 54, 35, 31, 13, 11.

The results obtained from the statistics herein brought under the notice of the society, are of such a character, that they cannot be too forcibly impressed on our minds, nor can any efforts be considered too great in the attempt to remedy so severe an evil.

Table showing the per centages of Thoracic Diseases in all classes of adults from 1837 to 1856 inclusive.

Years.	Miners.	Men not Miners.	Females.	Years.	Miners.	Men not Miners.	Females.
1837	100.	20.00	30.00	1847	68.75	13.32	14.81
1838	76.99	22.22	10.83	1848	84.21	35.71	22.22
1839	64.68	11.11	33.33	1849	55·55	37.50	31.57
1840	54.54	25.00	14.81	1850	40.40	31.57	20.62
1841	66.66	47.05	50.09	1851	57.14	35.28	23.32
1842	56.25	50.00	40.52	1852	74.99	24.99	30.30
1843	87.50	30.00	17.24	1853	53.84	38.45	44.44
1844	61.11	33.32	34.60	1854	30.00	47.05	9.09
1845	50.00	42.37	28.57	1855	50.00	39.99	13.07
1846	84.20	12.50	33.51	1856	70.00	22.22	29.40

A Table showing the average of Thoracic Diseases for every 5 years, from 1837 to 1856 inclusive.

Years.	Miners.	Males not Miners.	Females.
1837 to 1841	72.17	26.32	29.79
1841 to 1846	67.81	33.53	33.57
1846 to 1851	61.20	30.65	22.50
1851 to 1856	55.76	34.74	27.26

Average of the 20 years ending 1856.

Miners.	Males.	Females.
64.49	30.92	27.42

An inspection of this table will clearly show, that while the averages have been lessening during the last 29 years, yet that still the mortality among miners from one class of disease, is fearfully greater than that from the same class among the general population. In the five years ending in 1841, the consumption death rate among miners, was very nearly three times as great as the other males, and is double on the other years; and on the average of the 20 years ending in 1856, the death rate is more than double that of the general males, and considerably more than the females from the same cause. The miners being 64.49 per cent., and the general males 30.92 per cent.

In my next communication, the causes of these results will be examined; and if the society are not already tired of the subject, will be laid before them.

Remarks on the Natural History of the Par.

By JONATHAN COUCH, F.L.S., &c.

The following portion of the Natural History of the Salmon tribe was originally included in the paper on that subject which was presented to the last meeting of the Royal Cornwall Polytechnic Society; but when that paper was printed in the report of the proceedings of the Society, this part of it was, by some accident, overlooked. Now, therefore, it is again introduced to the notice of the Society.

THE PAR.

S. Salmulus, Willoughby's History of Fishes, p. 192, table No. 2. Yarrell's British Fishes, 1st edition, vol. 2; but not his figure, which does not represent this fish, being too high on the back, and too sharp and protruded before the eye.

Samlet, branlin, palmer trout; hipper in Devonshire; farthing trout of Carew—local names.

It has long been a question among naturalists, whether the little fish called a Par is a distinct species, or the young condition of the salmon, or at least of some of the larger species of the salmon kind. Several circumstances connected with the appearances or habits of the different kinds of this family have contributed to the continuance of these doubts; and that, too, in spite of the efforts of several close observers of the nature of these fishes to remove them.

The larger species of the salmon tribe which frequent the waters of Britain are known to deposit their spawn in the same rivers, and, for the greater part, under like circumstances; so that those persons who have sought to distinguish between them, or to settle the changes which pass among them in the course of their growth, by watching their progress from the egg to maturity, and for that purpose have taken them from their native bed and placed them, for observation, in a pond or artificial stream—have not been successful in satisfying other inquirers of the accuracy of their conclusions, in consequence of the great probability which existed of their having made their remarks on the eggs and young of more than one species—accidentally jumbled together. It is known that in their early state the young of most fishes of the same family bear a near likeness to each other; and in none is this likeness more decisive than in that of the salmon tribe. They also pass through several changes of colour and shape before they reach their distinctive adult condition; in arriving at which, they may be greatly delayed, or otherwise materially influenced, by finding themselves in situations not strictly agreeing with their natural habits. With the salmon, the peel, and the sea trout, a frequent change from salt water to fresh is necessary to their health, and even to their existence; although, to many families of fishes, such a change would be instantly fatal. By the common trout this migration from the river to the sea is sometimes adopted, although without regularity; but, in all cases, it is believed that the change is attended with an alteration in the appearance of the fish: thus tending to throw doubt on the observations derived from experiments made on the modes of growth and variety of changes which the different species of this family pass through from early youth to advanced age. In none of the species have those observations been more diversified, and the conclusions more contradictory than in the little fish we have now to give an account of.

As seen above, it is mentioned by writers under different names; and it would appear to have been chiefly on account of its small size, (its length rarely exceeding six or eight inches) that it was thought to be a young state of either the salmon or sea trout, to each of which it was supposed to bear a near resemblance; and wherein it differed, it was judged to be a sufficient explanation, that occasionally the salmon and sea trout, like most other fishes, are found to drop their spawn at an unwonted season of the year; which circumstance might be suggested as an explanation of the difference that may be detected between the Par and the usual appearance of the young salmon of the same size, as well as of the much less abundance of the Par in comparison with the acknowledged young of the salmon.

But what had tended most to excite doubt regarding the specific identity of this fish, was the fact that its body was marked with bands of a grey colour, which bands, or similar ones, are also a character in most, if not all, of the fishes of this family in the earlier stages of their growth. It was concluded, therefore, that the Par must necessarily be the young condition of some large species of this family, as if arrested development were an unheard-of thing in nature; and, as it bears a closer likeness to the salmon than to any other, the latest opinion among naturalists seems to be, that the Par is the young condition of that fish. We shall presently see whether this conclusion is to be adopted as undeniably a just one.

The more deeply coloured bands on the sides are a character belonging to the whole of the salmon tribe with which we are acquainted, so long as these fishes continue in their young condition; but it is conformable to what we often observe in nature, in finding them continuing through life in some species, whilst they have disappeared in others which have gone through greater changes. In all the true Pars which I have examined, there has been also a different form of those bands from what I have seen in either the young salmon or the young of the common trout. In those last-named species the bands are more expanded at the sides, and have less connection with the grey colour of the back than in the Par; but the form of the body, and especially of the head, with the distribution of the coloured marks on the body and fins, will offer a more decided mark of distinction than anything connected with the bands on the sides. In Mr. Yarrell's *History of British Fishes*, 1st ed., vol. 2, p. 42, he gives a figure of a fish which he terms a Par, with its history; but in the second edition this is omitted, and the long extract which is there taken from the papers of Mr. Shaw, as printed in the

New Edinburgh Philosophical Journal for October and January, 1837 and 1838, and in the *Transactions of the Royal Society of Edinburgh*, are sufficient to show the reasons of the omission. My friend had changed his opinion on the subject, and was now persuaded that the Par he had given a figure of, was no other than a young salmon. And such may have been the case; for the figure is far from being a representation of the Par as it is known to, and has been closely examined by myself. The snout is too long and sharp, as is the case, although in a less degree as regards its length, in Mr. Shaw's sketches; and in other respects it bears no more than a family likeness to the true Par of several rivers.

But what appears the most decisive test of the truth is yet to be produced. Mr. Shaw had said—"That the female Par does not spawn is undeniable; and although the male Par of eighteen months old is to be found in the river, with the milt flowing from it in abundance, all the winter round till about the end of February, yet no instance has fallen under my observation of roe in any female of the same age, or indeed of any age, having advanced to similar maturity. The female Par may be found in the river in autumn, in nearly equal numbers to the male, but the roe found in it has not the most distant appearance of approaching to maturity. I have also taken it at times during the whole winter, when the weather was mild, and still the roe had no appearance of advancing, and even up to the period of their migration it is to be found with the roe in the same immature state." He adds—"The apparent maturity of the male is a circumstance which cannot be reconciled with any of existing theories regarding the Par; and it is also, I confess, a difficulty not easily reconciled with the opinion I entertain as to its being the young of the salmon."

Mr. Shaw's perseverance, as well as candour, cannot be too much commended, and the effect has been to convince some of the most eminent naturalists of the truth of his opinion, although loaded with the difficulty above referred to. He was at the pains to capture a pair of salmon in the act of spawning—to bring their eggs to maturity, and to watch them through the whole proceeding of their development into what he persuaded himself was the condition of the true Par; on the truth of which last conclusion, the whole argument appears to rest. But how far this argument may be trusted we gather from the remarks of Dr. Knox, the well-known author of a work entitled, "Fish and Fishing in the lone glens of Scotland." He says—"Soon after these observations had been made and submitted to the Royal Society of Edinburgh, others entered on the field; and the Duke of Buccleugh must have taken some interest in the matter, since he permitted one of his gamekeepers, a Mr. Shaw, to experiment on the ova of the salmon, and on what he called the Par. The ideas of this person respecting the Par, have no foundation whatever, either in observation or experiment. The experiments he made, led to what is called the two years' theory of the May smolt. By confining the young of the salmon in ponds and boxes, and placing them under artificial circumstances, he contrived to retard the growth of the fry to the extent specified: thus he first misled himself, and then others." When I first heard of the two years' theory of the age of the May smolt, my remark was this: wait a little, and another experimenter, proceeding on the same principle or want of principle, will prove to you that three years is the age; and after a little while, another of the same class will show you that one year is the true period. The prediction was verified to the latter. Mr. Hannay, of Kirkudbright, showed by experiment that the smolt is a three years old fish; Mr. Young, of Invershin, by the same method, proved one year to be the true age, and the experiment repeated at this moment by Dr. Esdaile, of Perth, on ova reared in ponds adjoining the Tay, has brought to a sudden close, and for ever, the two year old theory—a delusion of the plainest character, but sufficient to mislead many naturalists. (Zoologist, No. 154, for August, 1855.)

Mr. Shaw had not obtained Pars in the spring, and supposed that they had migrated to the sea; but they have been obtained in the month of March, as well as through the remaining months of the year; and there is no other reason than Mr. Shaw's want of success why the conclusion should be formed that they ever pass into salt water. This observer had found himself at a loss to understand how this fish—regarded as an incipient salmon of six inches in length, and not having the hooked jaw as all undoubtedly male salmon are known to have—could be in a state capable of shedding its milt, whilst no females were obtained in a corresponding condition; but although the instance was not singular as regarded numbers, he endeavoured to reconcile the fact with his theory, by supposing that however frequently it might happen, it was still an abnormal condition.

This difficulty, however, is now removed, and with it the opinion it was brought to support; as will appear from the following particulars, of which the anatomical position is especially important.

In the early part of January, I obtained from the Lerryn branch of the river Fowey, a basket of fish, of which trout and par were in equal numbers. None of the former had visible milts or roe, nor had any of the latter that were less than five inches in length. But examples that measured six inches were severally supplied with milt and roe, fully developed and ready to be shed. It is a remarkable circumstance, and as such I have referred to it above, that the milt was in a single lobe of rather large size, and as such a figure was taken of it. Accident only prevented the roe from being dealt with in the same manner; but it is a well known law of nature, that both sexes should in this respect be formed in the same manner. The salmon has those organs developed in double lobes.

A description of the true Par can best be given by comparison with a trout of the same size; which is done with particular reference to a remark of Sir William Jardine, whose particular attention has been directed to the study of the natural history of the salmon tribe. It will not form an objection to the authority of his opinion in the present case, that he has been afterwards led by the plausibility of Mr. Shaw's experiments to express a different opinion; since the latter have been since shown to be ill-founded. Speaking of the uncertainty attending the specific nature of this fish, he says—"it has latterly resolved itself into the question—whether the Par was distinct or a variety, or young of the common trout—S. Fario:—with the migratory salmon it has no connection whatever."—*Edinburgh New Ph. Journal*, Jan., 1835. The forehead of the Par is shorter than that of the trout, the gape less, under jaw weaker, teeth finer, as is particularly seen on the tongue, round the palate and along the vomer. In the fore part of this last-named bone, the double line of teeth is more separated, or in a loop. The pectoral fin is longer and more full, the adipose fin differently shaped, and without the bright red border seen in the trout. The first dorsal fin is plain, with a dark border in front, without a light margin; anal fin plain, without the light coloured border seen in the trout. Some examples have spots on the first dorsal fin; the red spots on the body are not surrounded with a pale ring, and they are fewer in number—none below the lateral line, along which they run at regular distances. The lateral bands vary a little in different examples, but in all they differ from those of the trout. They communicate with the colour of the back in all their breadth; but the deepest tint is low on the side—contrary to the habit of the trout, in which they gradually grow fainter; nor is it usual with the trout to retain any bands at so late a period of growth. The Par is found, sometimes in abundance, in the larger rivers of most parts of England and Scotland, and takes the usual baits which suit the trout; but the peculiar habits by which it differs from the trout are little known, except that it does not prefer such rapid streams as the other seems to delight in.

THE HUCHO.

In my paper on the salmon tribe of fishes printed in the last Report of the Society, there is an account of a fish which, guided chiefly by the authority of Dr. Fleming, I referred to the Hucho—a species of that genus hitherto known only as occurring in some one of the rivers of Germany. There are no means existing at present of knowing the reasons by which that excellent naturalist was guided in thus referring the fish he describes to the German species, beyond the fact which may be supposed, of its lengthened form, and the absence of teeth from the vomer bone, or middle line of the palate; but it since appears that some mistake in this instance has been committed, which I consider it a duty to set right as far as I am able. But that the fish is specifically different from all the known species of this family known in Britain I do not entertain a doubt; and therefore it must be permitted to rest in a state of uncertainty until further research shall set the question at rest. The following quotation from a private letter will set this matter in a correct point of view—premising, however, that the writer of it is Dr. Gunther, who is at present labouring at the British Museum, in describing all the fishes in the National Collection, and in pointing out those in which that collection is deficient. "I know," says he, "our German salmonidæ pretty well with regard to their specific character and habits, but I must say that when reading through your accounts, the question has been raised nearly in every page: Are the English and Continental fishes representatives of the same species, with different habits according to the difference of the localities inhabited, or are they really different? With regard to the salmon, I must confess, besides, that I do not yet know whether the Rhenish Salm and Lacks are the same or different, much less to which of the British species they are to be referred. And I am sorry to say that there is at present not one observer living on the Rhine who, like you, will continue his observations through years. Of one point, however, I think I am certain, that the Cornish S. Hucho is *not* that of the Danube. I have *never* found that fish in a river which does not belong to the system of the Danube. Several tributaries of the Rhine and of the Elbe are, as you know, distant only a few miles from those of the Danube; nevertheless S. Hucho never occurs in the former, whilst it is plentiful in the latter. The fish has been transferred to rivers and lakes beyond the system of the Danube; the experiments have failed, and the specimens disappeared. Are we, therefore, not permitted to doubt its reappearance in Cornwall?"

THE INDUCTOMETER.

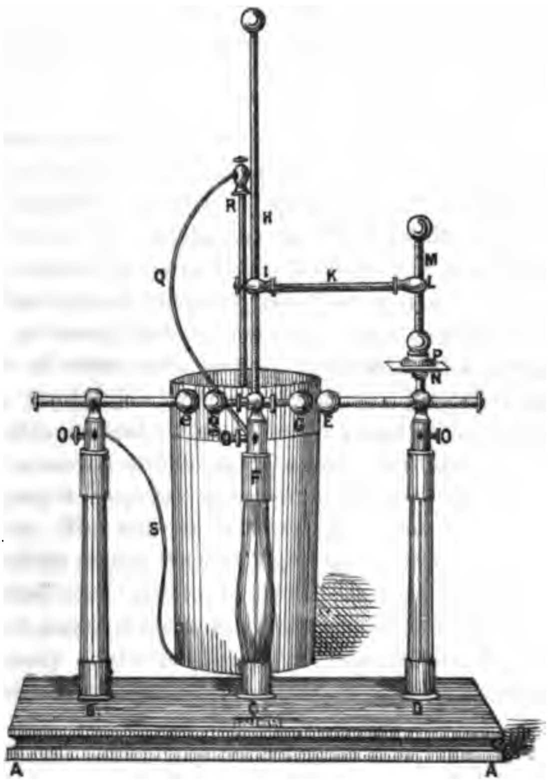
BY J. N. HEARDER.

A new instrument for determining the specific inductive capacity and insulating power of dielectrics, by frictional electricity.

The enormous outlay involved in the construction of a submarine telegraph cable, and the ruinous consequences of its failure, render the practical determination of the problem—what is the substance best suited for insulation?—a matter of the deepest importance.

Hitherto gutta percha has been generally considered as the most eligible substance for this purpose, probably on account of the facility with which wires can be coated with it. The frequent failures, however, which have occurred in cables after they have been laid, in consequence of the insulation becoming defective, and the great difficulties experienced in working through very long lines, from the disturbing influence of the inductive action, have induced electricians to turn their attention towards the discovery of a substance which should be free from these defects. Within the last few years some most important experiments have been made with india rubber as an insulating medium, and with very great success. Valuable papers on the subject have been laid before the British Association by Messrs. Hall and Wells and by Mr. Silver, and the scientific journals of the day teem with discussions on the respective merits of the two rival substances—gutta percha and india rubber.

Although perfect insulation is of paramount importance, yet there are other qualities which an insulator should possess in addition to its electrical impermeability, and of these, the most important is low inductive capacity—that is to say, small capacity for receiving static charge. The conditions of the Leyden jar, which are fulfilled in a submerged coated wire—the wire forming



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As this effect is identical with that which takes place in the actual working of a telegraphic line, it is almost the only test used by electricians. Since, however, it can only be depended upon when instruments of extreme accuracy and a considerable length of cable are employed, the experiment is often an expensive one. I have therefore thought it desirable to contrive an instrument by which the specific inductive capacities of dielectrics and the effects due to variations in their thickness might be examined by using very small samples either before or after manufacture, and I have had the satisfaction to succeed very perfectly.

For this purpose I have employed frictional electricity, and the rationale of the process which I adopt is as follows :—

All good insulating substances are capable of being charged when laminated and placed between metallic coatings, after the manner of a Leyden jar or plate. The amount of charge which equal coated surfaces will take up—the tensions being equal—will be directly as their specific inductive capacity, and inversely as their thickness. To determine this, I take a Leyden jar holding about a square foot of surface, which I employ as a standard, and placing it on the table, I connect with the inner coating a Lane's discharging electrometer, adjusted so as to discharge the jar when the tension is sufficient to overleap the interval of one-tenth or two-tenths of an inch. Now if I charge this jar by a number of small units of quantity, the value of each unit will be determined by the number required to produce the discharge; and if in one case I find a hundred units necessary, and in another case only fifty, I take it for granted that the value of these units is as one to two, the fewer number having the greater value.

I next take a number of dielectrics, all in plates of the same size and thickness, and having equal areas of their central portions, coated on each side with tinfoil or any metallic conductor. If one of these coated dielectrics be connected with a discharging electrometer, adjusted to a very minute discharging interval, say one-twentieth or one-fiftieth of an inch, it will discharge whenever the tension has reached this point; but the quantity of electricity contained in that discharge will vary according to the nature or thickness of the dielectric. Let, now, one of these coated plates be insulated, and have one of its coatings connected with the conductor of an electrical machine, and the other with the inner coating of the standard jar, so that the discharge through the electrometer connected with the coated plate under examination shall not pass to the ground, but into the jar serving to charge it. Let the number of discharges from the coated plate required to cause the jar to discharge through its own electrometer be noted. These may represent the inductive capacity of the dielectric. Let now a different dielectric be substituted for the first, all other things—the discharging intervals, &c—remaining the same, and let the number of discharges requisite to charge and discharge the jar be noted as before.

The specific inductive capacities of the two dielectrics under examination will be inversely to each other, as the numbers of their respective discharges, since the value of each unit of discharge must be greatest in the one giving the fewest. In like manner, the law regulating the inductive capacities of various thicknesses of the same dielectric may be ascertained by coating equal areas of such plates, and estimating the value of their respective units of discharge.

As, however, the employment of two discharging instruments for this purpose was frequently inconvenient, I contrived the instrument which I have the honour to submit for the consideration of the judges of the Royal Cornwall Polytechnic Society, and to which I have given the name of Inductometer.

It is in principle a double discharging electrometer, and is so arranged that the dielectrics under examination, together with the standard jar, are all connected with, and perform their various functions in different parts of the same instrument.

It consists of a flat mahogany base AA, upon which are fastened in a line with each other and about three inches apart, three strong glass pillars about eight inches high, B C D; the two end ones are surmounted, each with a horizontal sliding wire terminated by a brass knob E e, and graduated to tenths of an inch. These wires slide in the same longitudinal line, and their brass knobs point towards the centre pillar C. This pillar is surmounted by a brass cap, F, from opposite sides of which project two brass wires, terminated by balls, G g, so contrived as to be capable of being brought exactly in contact with the knobs, E e, of the before-mentioned sliding wires when they stand at zero. Thus adjusted, all the wires and knobs stand in one and the same line. By means of micrometer screws, the balls, E e, connected with the sliding wires on the end pillars can be withdrawn to any required distance from the corresponding knobs, G g, on the centre pillar, thus forming two discharging intervals. From the centre pillar rises a stout upright wire, H, carrying a slider, I, from which projects horizontally, a brass wire, K, terminated by a ball, L, through which also slides vertically a brass wire, M, about four inches long, carrying a knob at each end. The horizontal wire is of such a length as to allow this last-mentioned vertical sliding wire to stand exactly over the centre of one of the end glass pillars, D, upon which is screwed horizontally a flat brass disc, N, of about two inches diameter. The cap of each brass pillar is furnished with a binding screw, O O O, for making the requisite connections.

To use the instrument, the end glass pillar surmounted by the flat brass disc, is connected with the prime conductor of an electrical machine, which conductor should be very small, the smaller the better. Upon the brass disc, N, is laid a plate about three inches square of the dielectric to be tested, and upon this a second brass disc P, of similar diameter but of five or six ounces in weight, is placed exactly over the lower one, the knob of the sliding wire, M, connected with the centre pillar rests upon the last mentioned disc. These two brass discs serve as metallic coatings to the dielectric to be tested. A wire, Q, from the cap of the centre pillar, C, proceeds to the knob of the standard Leyden jar, R, and a wire from the cap of the third pillar, B, to its outer coating. Great care must be taken to varnish all the glass surfaces, and to keep them perfectly dry, as a very small amount of leakage from moisture will produce great errors in the results. Matters being thus arranged and the discharging knobs between the pillars set at a distance of 1-20th or 1-50th of an inch from each other, if the machine be turned, the under surface, of the dielectric to be tested will go on charging until the tension is sufficient to discharge to the proximate knob of the centre pillar, which is in conducting communication with its upper surface. The quantity thus transmitted passes to the inner coating of the Leyden jar, and may be considered the first unit.

The dielectric now receives a second charge, which in a like manner discharges, and is conveyed to the Leyden jar, constituting the second unit or measure. In this way successive discharges pass and are measured into the Leyden jar until it has itself received sufficient to discharge between the centre pillar and the proximate knob in conducting communication with its outer coating. As this discharge passes to the gronnd, the whole system is rendered neutral, and the experiment is concluded. Since the same quantity in the Leyden jar will always discharge over the same interval, it follows that the number of units or measures thrown into it from the dielectric will be the fractional parts of the charge of the jar and the specific inductive capacity of the dielectric may be represented by this fraction.

If the dielectric be removed and a similar plate of another kind of dielectric inserted in its place, all other things remaining the same, the number of units now required to discharge the Leyden jar will give the fraction, which will represent its inductive capacity. If, however, these numbers be compared with each other as whole numbers, then the inductive capacities of the substances compared will be in the inverse ratio of them.*

* In all these experiments, however, it must be borne in mind, that a certain effect is also due to the quantity transmitted by the conductor, which gives up its share at every discharge of the dielectric. It is, therefore, necessary, first, to ascertain the fractional value of the conductor alone, by carefully counting the number of sparks which will pass the discharging interval in order to charge and discharge the standard jar. This fraction being ascertained it will always form a constant quantity to be deducted from the apparent fractional value of the dielectric.

Another mode of using the instrument is to substitute in the place of the dielectrics to be tested, an extremely small coated plate of glass or other dielectric, which is itself to act as a standard unit of measure. The discharges between this and the centre pillar will always be of the same value. The dielectrics to be tested must now be inserted in the place of the Leyden jar, one coating being in connection with the centre pillar and the other with the third pillar, which, again, must connect with the ground. The number of discharges now required to make each dielectric discharge over a given interval, will indicate the exact ratio of their specific inductive capacities.

This instrument affords a ready means of determining not only the law of radial induction through cylindrical dielectrics, but the relative merits of various modes of insulating telegraph cables, and this, too, with only a few inches in length of each sample. For this purpose the circular disc, N, on the first pillar is removed, and a small brass cup inserted in its place. The vertical wire M, with its sliding tube L, is removed from the end of the horizontal arm K, and a brass ring, about one inch in diameter, is screwed on in its place.

The pieces of telegraph cable to be tested are cut into lengths of about twelve inches. The insulating coating is removed from one end, so as to leave about half an inch of the internal wire bare. The other end of the cable is covered with a resinous cement, to conceal the end of the wire. Each sample is then coated externally with tinfoil to within an inch of each end, taking care that all the coatings of tinfoil shall be of the same length. Leyden tubes or jars are thus formed, which are to take the place of the dielectrics before described. It is merely necessary to support them vertically by passing them through the ring against which the tinfoil coating should rest, whilst the wire protruding from the lower end stands in the brass cup placed for that purpose. Small as these samples are, they receive very definite amounts of charge—so definite, indeed, that the number requisite to produce the consecutive discharges of the standard jar will sometimes not vary more than two or three per cent. in a dozen experiments.

The effects due to the various relations of the diameters of the dielectrics and their included conducting wires to each other, are shown by this instrument with extraordinary accuracy, and the laws regulating these results are readily determinable.

As different dielectrics possess very different degrees of impermeability to the electricity, variations in these qualities may be also ascertained by this instrument. In this case it is only necessary to place the dielectrics between the charging discs, as before described, and connect the cap of the centre pillar with the table, instead of the Leyden jar, which is now dispensed with. The discharging interval between the knobs E G is to be gradually increased until the distance is so great that the electricity prefers breaking through the dielectric between the discharging discs. The relative degrees of impermeability will thus be indicated by the amount of tension which they will bear before breaking down. Of course this will only hold good with certain classes of dielectrics, for the resistance of glass is so great that it would be extremely difficult to accumulate upon it a tension enough to break through it. The softer materials, however, easily yield, and give very good results.

Contributions to Falmouth Fauna.

BY W. P. COCKS. 1860.

"I am persuaded that the more we inquire and search into the economy of nature, so far from finding any defects, we shall have more and more reason to be convinced that not only every bird, but every animal from the highest to the lowest in the scale of creation, is equally well adapted for the purpose for which it was intended. The chief object of a naturalist should be always to *look through nature up to nature's* God; and if we do so with a sincere desire to be benefited by the survey, we shall have fresh cause for wonder and admiration, and find our minds more fitted to receive the good impressions which such a study must produce."—*Jesse.*

"The desire of knowledge is natural to every man; but what advantage is it to be knowing, if that knowledge be not seasoned with virtue and religion? The vilest peasant, and he whom we in scorn think least removed from a brute, if he serve God according to the best of his mean capacity, is yet a better and more valuable man than the proudest philosopher who busies himself in considering the motion of the heavens, but bestows no reflection at all upon those of his own mind. The certain consequence of knowing a man's self truly, is a mean opinion of himself, and not being exalted with the commendations of other people. And supposing my knowledge so vast and extensive that nothing this world contains were hid from it, yet what would all this avail me in the sight of God, who, when he comes to judgment will try me upon the issue, not of what I have known, but what I have done?"—*Thomas a Kempis.*

O Lord how manifold are thy works! in wisdom hast thou made them all.—*Psalm* civ. 24.

ORDER—CHONDROPTERYGII OR CARTILAGINEI, CUV.

Bones cartilaginous, soft, cranium formed of one piece. The maxillary and intermaxillary bones either wanting or rudimentary, and their functions are filled by the palatines and vomer.

When calcareous matter is observed, it is found to be deposited in small granules and not in distinct fibres as in fishes with true bone.

FAMILY—STURIONIDÆ—STURGEONS.

Branchial openings much cleft, furnished with an operculum, but without rays in the membrane, branchiæ free.

Sturgeons inhabit the seas of Northern Europe and America. They migrate during early summer into large rivers and lakes, and after depositing their spawn, return again to the sea. *Leuwenhoeck* found in the roe of one 150,000,000 ova, and *Catesby* declares that the female frequently contains a bushel of spawn.

Dr. E. Grey in his catalogue of cartilaginous fish, published in 1851, gives the following species.

Acipenser glaber, Heckle. Caspian Seas, Lakes of Siberia, Lake Arel.
——— Chinensis, Grey. China.
——— Gmelini, Fetz and Heck. Danube.
——— Ruthenus, Linn. Caspian Sea, River Volga, and Ural.
——— Aleutensis, Fetz and Heck. North Sea.
——— maculosus, Rufin. North America.
——— oxyrhyncus, Rufin. Gulf of Florida.
——— rupertianus, Forst. North America.
——— transmontanus, Richardson. Columbian River.
——— Carbonarius, Agassiz. North America.
——— stellatus, Klein (A. Helops, Pall.) Caspian Sea. This specie is about four feet long, and is so numerous that a single vessel will in the course of a fortnight capture 16,000 or 20,000.
——— Schypa, Gmel. Russia.

Acipenser Guldenstadtii, Brandt et Ratz. Caspian Sea.
———— Heckelii, Fitz. Mediterranean.
———— sturio, Linn. North Seas, etc.
———— latirostris, Parnel. North Seas, etc.
———— brevirostris, Cuv. North America.
———— rubicundus, Rafin. North America.
———— macrostomus, Rafin. North America.
———— dauricus, Brand. Caspian Sea.
———— Huso, Linn. Northern Caspian and Mediterranean Seas, Rivers Volga and Danube. *Pallas* de scribes one that weighed 2800 pounds.

Scaphirhyncus cataphractes, Grey. North America.
Polyodon spatula, Grey. North America.

GENUS—ACIPENSER, LINN.

Body elongated, angular, furnished, as well as head, with rows of bony plates, mouth placed under the snout, cylindrical, protractile, without teeth, four cirri beneath the snout.

A. sturio Linn.—Common or sharp-nosed sturgeon (name derived from the German Storer or Stoer, which signifies to dig the mud) an occasional visitor. A young sturgeon, 3 feet 2 inches long, and 10 inches circumference, was caught in a ground net at Swanpool, August, 1845.

The sturgeon grows to a very large size; specimens have been taken that measured 20 feet long. One was caught in the river Eske, Scotland, that weighed 460 pounds. It is called the Royal Fish, because when thrown upon the shore, or caught near the coast, it belongs to the crown. When taken in the Thames it is always presented by the Lord Mayor to her Majesty. "Item habet warectum mares per totum regnum ballenas et sturgiones capitos, etc. Edward II., anno 17mo." A fine sturgeon has been taken in the river Thames, near Greenhithe, which was forwarded to her Majesty the Queen, at Windsor, by order of the conservators of the river.—*Illustrated London News*, April 15, 1860.

A. latirostris, Parnell. Broad-nose sturgeon. Description—Head large, depressed, snout broad, short, blunt (snout in the common sturgeon, long and pointed,) mouth small, puckered, cirri four, long, stout, two and a half inches from tip of snout, eyes rather small, greyish, nostrils small, body bulky, angular, with five rows of bony plates of an oval shape, minutely punctured and radiated, skin very rough, of a brownish-grey colour, on the back, greenish-yellow with reddish-brown spots on the sides, throat, abdomen, and under surface of tail white. Five feet eight inches long, depth at the shoulder 10¾ inches, breadth across the head, 10 inches. Superior lobe of caudal fin, 20 inches long, lower one 8 inches, dorsal 8 inches. Taken in a trawl net, Nov. 3, 1848, five miles south of Falmouth Harbour. May 5, 1850, one was caught by the men employed in Mr. Snow's boat, a few miles from the harbour, weighed 160 pounds. August 5, 1852, two were taken in a ground seine by Mr. Tiddy, of St. Mawes; one measured 9 feet, and the other 7 feet 5 inches.

The Caspian and Aral seas yield the various kinds in great abundance. At the station of Sallion, on the Persian coast, 15,000 of the common sturgeon are sometimes taken in one day with hook and line, and upwards of 700,000 were taken in the year 1829, in the Russian dominions on the coast of the Caspian. A great number of fishermen are employed in the mouth of the Volga, on the Caspian Sea, to catch them in an enclosure formed by large stakes, representing the letter Z repeated several times. These fisheries are open on the side next the sea, and closed on the other, by which means the fish, ascending in its season up the river, is embarrassed in these narrow angular retreats, and so is easily killed with a harping-iron. The Hon. Capt. Keppell, describing the method of catching sturgeon in the fishery of Karmaizack, says:—Two persons are in each boat, one (generally a female) rows, while the other hauls in the fish. The instruments used consist of a mallet and a stick with a large unbarbed hook at the end. Every fisherman has a certain number of lines—one line contains 50 hooks; these are placed at regular distances from each other—they are without barbs, sunk about a foot under water, and are kept in motion by small pieces of wood attached to them. The sturgeon generally swims in a large shoal near the surface of the water, and upon being caught by one hook, he generally gets entangled with one or two others in his struggles to escape. Immediately on our arrival the boats pushed from shore. Each fisherman proceeded to take up his lines. On coming to a fish, he drew it with his hooked stick to the side of the boat, hit it a violent blow on the head with the mallet, and, after disengaging it from the other hooks, hauled it into the boat. On every side the tremendous splashing of the water announced the capture of some huge inhabitant of the deep.

Sturgeons are so common in the Canary Islands as not to be valued, and at Albany the fish is sold at a penny per pound, and is called Albany beef.—*Long's Travels in North America.*

The lakes and shores near Pillau, a seaport in Prussia, are divided into districts and let to companies of fishermen, some of which are rented for 6,000 guilders (a guilder is worth 1s. 8d.)

Capt. Keppell describes one merchant at Karmaizack as holding thirty fisheries, for one only of which he paid an annual rental of 450,000 roubles (a rouble is worth 3s. 1d.)

The value of the different sorts of sturgeons, and their products caught in the Caspian in an ordinary year, is said to amount to £300,000.

The sturgeon, says E. P. Thompson, Esq., is not very common in the Neva, but specimens are occasionally caught, and some of large size in the seines used at the salmon fisheries. If they are not bought on the spot and cut up for the sake of the *caviare*, a hole is made in the cartilage of the nose, through which a rope is passed, and the end attached to the stern of one of the floating fish stalls, thus enabling the fish to swim about till its doom is settled. I have often hauled in the rope to have a close inspection of the fish, which, from its great strength and resistance, is no easy task. Hideous and alligator-like in its appearance, it is one of the most timid fish known. Goldsmith observes:—It is a harmless fish, and no way voracious. It never attempts to seize any of the finny tribe, but lives by rooting at the bottom of the sea, where it makes insects and sea plants its whole subsistence. This great fish must therefore be a very slender feeder. Hence has arisen the German proverb which is applied to a man extremely temperate, when they say—*He is as moderate as a sturgeon.* The flesh of the sturgeon has the appearance and consistency of veal, and was highly esteemed by the Greeks and Romans. Pliny states that it was brought to table with much pomp and ornamented with flowers, the slaves who carried it being also adorned with garlands and accompanied with music. Donovan observes:—Slices of sturgeon, nicely dressed in the manner of veal cutlets, are only distinguished from the latter by the superiority of the meat and a certain superadded flavour. This resemblance to veal is equally observable in the appearance of the flesh both raw and fried, as well as in the taste. It is usual to make sturgeon pies, and these are scarcely distinguishable from meat pies. I believe that sturgeon is the only fish which is roasted on a spit like meat.

To roast, put a good-sized piece in a large cradle spit, (five or six pounds) stuff it with forcemeat, keep it at the fire for two or three hours, but remove the skin, cover it with crumbs of bread, and brown it with the salamander, baste it continually with butter, and serve with a good brown gravy, an anchovy, a squeeze of Seville orange or lemon, and a glass of sherry boiled up and poured into the dish.

Sturgeon a la Russe.—When the sturgeon is cleansed, lay it for several hours in salt and water, take it out an hour before it is wanted, rub it well with vinegar and pour a little over it, then put it into a fish-kettle, cover it with boiling water, one ounce of bay salt, two large onions, and a bunch of sweet herbs. Stew it in common wine or strong ale until the bones will separate easily, then take it up, remove the skin, flour it, and place it to brown before the fire, basting the fish well with butter. Serve up with a rich sauce made of beef gravy and red wine, highly seasoned with spice and a garnish of pickles.

It should be firm; if flabby, its value is greatly lessened. It is salted and dried for consumption during the feasts enjoined by the Greek church. Pickled sturgeon is sent all over Europe. Mr. Long, the North American traveller, speaks highly in favour of sturgeon broth.

Caviare is prepared as follows:—The roe is freed from its membranes, washed in vinegar, and dried on a board in the open air It is then salted, put into a bag and pressed, and finally packed in small barrels for sale. J. E. Thompson says:—Caviare when fresh, is held most justly in the highest estimation as an exquisite delicacy and relish; but, excepting on the occasion of a local fish being caught, it is not to be had till late in the season. In its fresh state the pressed or prepared article can be had at all times, but it retains little of its original flavour, and it is used only by the poorer classes. Its appearance is dark and untempting, whereas the fresh, with its delicate amber tint, in a kind of semi-fluid state, is a *positive luxury*, but it is not available to the gastronomists of the capital till late in the autumn, when it arrives from the Caspian Sea.

The Russians use it before dinner as a whet, flavoured with the slightest *soupcon* of onion, on a foundation of bread and butter, and crowned with a small glass of liqueur. The best is made of the roe of the sterlet. The quantity shipped from the Black Sea and Sea of Azof in 1833 was nearly 2,000,000 lbs.

The following are the principal species from which the *Russian Isinglass* is derived. (Isinglass, a word corrupted from the Dutch *Hyzenblas*, an air bladder, compound of *hyzen*, to hoist, and *blas*, a bladder.) A. Huso—A. Gouldenstadtu—A. Ruthenus—A. stellatus—Silurus Glanis—Saluth of the Swiss, Wels or Scheid of the Germans.

The exportation of isinglass from the Russian capital is estimated to be about 152,000 pounds every season—a period of six months.

The air or swimming bladder is composed of an external or peritoneal covering, a middle or fibrous coat, very strong, and a delicate, highly vascular membrane, that lines the internal surface. This reservoir of air is placed beneath the spine, and firmly bound down by the peritoneum. By compressing the bladder, the fish sinks in proportion to the degree of pressure to which the contained air is subjected; and as the compressed air is again permitted to expand, the animal becomes more buoyant, and rises towards the surface.

Biot has found, from his experiments, that the proportion of oxygen in the air-bladder increases with the depth of the water in which the fish usually lives, from a small quantity up to 87 per cent.

It is certain, says *Cuvier*, that fishes in which it has burst remain at the bottom of the water, and are turned upside down, no longer enjoying the facility of motion which they exercised before.

A fish, in a vessel, was placed under an air pump ; its bladder burst as the air was exhausted, it sank immediately and could not rise again, but from that time, crawling like a serpent, moved along the bottom. —*Borelli.*

Six or seven years ago I secured a gurnard (Trigla hirundo, Linn.) that was floating on the surface of the water (Gwyllyn Vase) on its back, perfectly helpless from a distended air-bladder.

Isinglass—preparation.—The air-bladder (sound) is taken from the fish while fresh, slit open, washed in water and freed from the thin membrane which covers it ; then it is beaten and exposed to the air to stiffen a little. In this state it is formed into a roll about the thickness of the finger, and in length according to the intended size of the staple, (long or short.) A thin membrane is generally selected for the centre of the roll, round which the rest are folded alternately, and about half an inch of each extremity of the roll is turned inwards. The sounds are sometimes folded into leaves like a book, or simply dried without any care. Cake isinglass is formed of the bits and fragments of the staple sorts put into a flat pan with a very little water, and heated just enough to make the parts cohere like a pancake when it is dried. The rolled or twisted isinglass is the best ; the next best kind is the book isinglass. Good isinglass is white, semi-transparent, rather thin, quite inodorous, and insipid. Professor Normandy says ;—When a thin piece of genuine isinglass is looked through by holding it before the eye and daylight, a sort of shining appearance or chatoiement may be observed. And, according to Mr. Hatchett, it consists almost entirely of gelatine —more than 98 parts in 100. Dr. Bostock states that when one part of isinglass is dissolved in 100 parts of hot water, the solution, on cooling, is wholly converted into a jelly. It undergoes little or no change when kept dry; but in the gelatinous state, or when dissolved in water, it very soon putrifies. Isinglass is used for the clarification of fermented liquors; (this property depends upon its membraneous texture entangling the impurities, just in the same manner as albumen when coagulated by heat, does,) and is indispensable in the preparation of blanc-mange, ices, creams, and other delicacies for dessert, stiffening crape, silk, straw, &c., making sticking plaster, cements, fixing chalk drawings, and other purposes. An inferior isinglass is prepared for sale from sea wolves or cats, porpoises, sharks, cuttlefish, whales, cod, ling, holobut, soles, rays, flat fish, &c. The head, tail, fins, skin, &c., of these are boiled in water, the liquid skimmed and filtered, and then concentrated by evaporation till it gelatines on cooling; at that degree of concentration it is cast on flat slabs, and cut into ribbons or tablets, &c. Dr. Normanby states that isinglass is often imitated with the intestinal membranes of the calf and of the sheep. This spurious article may be recognised because it does not exhibit the shining appearance before alluded to when held before the light, and because, although inodorous, it has a saltish flavour, and is generally in thinner pieces than the genuine isinglass. If it be torn asunder, it will be observed that it may be rent in all directions, while genuine isinglass cannot be divided otherwise than in the direction of its fibres. The sounds or air-bladder, which yield the finest isinglass, consist of parallel fibres, and are easily rent longitudinally; but the ordinary sorts are found composed of double membranes, whose fibres cross each other obliquely, resembling the coats of the bladder. If a piece of artificial isinglass be macerated in water, it swells, but instead of retaining its shape, as is the case with genuine isinglass, it becomes divided into small pieces, forming a sort of curdy precipitate; and if treated with boiling water, about one-third of its weight is left in an insoluble state, and the liquor does not form a good jelly.

Extracts from evidence taken before the Parliamentary Committee, 1855.—Out of 28 samples (isinglass) 10, or more than one-third consisted entirely of gelatine. The price of the genuine varied from 8d. to 1s. 4d. per ounce, while gelatine ranged from 10d. to 1s. 4d. per ounce.—*Dr. Arthur Hill Hassell.*

Now, as isinglass is very different from gelatine in many of its properties, and as it is undoubtedly much the superior of the two, it is evident from these inquiries that the public are seriously imposed upon and injured by the substitution for isinglass of such an article as gelatine.—*Ib.*

Isinglass has been very much adulterated with ordinary gelatines.—*Robert Warrington, Esq.*

Isinglass was another substance which was adulterated, and those adulterations came specially under my own notice. I have here a specimen of adulterated isinglass which was examined by myself; it was adulterated with gelatine, by rolling a sheet of gelatine between two sheets of isinglass, and then cutting it up in the usual way. The public would not be able to detect the difference, there was about one-third of gelatine. The difference in price of the two articles is very great. The gelatine which was used was worth about 2s. a pound, and the isinglass adulterated with it was worth 16s. a pound.—*Dr. Theophilus Redwood.*

The best indication of this adulteration is the amount of ash; isinglass yields only 0·9 per cent., while gelatine yields 4 per cent., and adulterated isinglass 1·5 per cent., or more.

Jellies are often prescribed by medical men during the convalescence of a patient, when the stomach is very irritable, and if those jellies are made of *gelatine* which has been exposed to a high temperature, they will generally disagree with him, whereas jelly made from *Russian isinglass* would not do so. The element is not precisely the same in the two cases, it has undergone a *molecular change*. In fact, there is only a *molecular* difference between isinglass and gelatine. The fact of there being that *molecular* change, leads to a different effect in the administration of that gelatine upon the system.—*Dr. Henry Letheby.*

Most of the gelatine which comes from France, comes from a large *horse slaughterer* in the neighbourhood of Montmartre. Not many years ago there was put into my hands by the excise something they knew nothing about. It came in at an *ad valorem* duty, and they asked me what it was. I found it was the hamstring of the horse, and it was traced to a large gelatine maker. —*Ibid.*

Gelatine is extracted from the bones of the ox and the sheep. It is obtained by boiling bones in water under pressure. It is more readily procured by employing bones which have been previously digested in hydrochloric acid to extract the phosphate of lime. In this way a soup is prepared in Paris for the hospitals and other pauper habitations. The *patent gelatine* of the shops is obtained, I presume, from bones. It is sold either plain or coloured, and used as a substitute for isinglass. Gelatine has been extracted from antediluvian bones. A soup was prepared from the bones of the great mastodon by a prefet of one of the departments of France.—*Dr. Pereira.*

The quantity of gelatine in the different states of glue, &c., may be ascertained by estimating the amount of water it is capable of absorbing; because the amount of water contained either chemically or otherwise in different gelatine varies very much. For this purpose a weighed quantity of the gelatine is immersed in cold water for twenty-four honrs; the water that is not absorbed is then poured off, and the gelatine weighed. Very good kinds are thus increased in weight thirteen times; average kinds ten times, and inferior kinds six times. The consistence of the residual jelly should also be observed—the more solid it is in proportion to the amount of water absorbed, the better is the gelatine.

Swinborne's patent refined isinglass!! The process of making. —The patentee takes hides or skins, or parts thereof, as fresh and sweet as possible and free from hair, and reduces the whole into shavings or thin films by any suitable instrument. He soaks the shavings or films for about five or six hours in cold water, and then changes the same; he repeats such changing of the water two or three times each day, until no smell or taste is to be detected either in the water or in the shavings, and then he removes the shavings from the water. If this product is intended for soup, it is dried on nets, and is then ready for use. If gelatine is to be extracted, the shavings, after the above, are put into a suitable vessel with a quantity of water sufficient to cover them when pressed down, and they are subjected to a heat not exceeding boiling water. When dissolved, the gelatine is to be strained through linen or other fabric, subjected to slight pressure with the hands or otherwise; or the solution may be permitted to run off from the vessel without straining, by which means much of the gelatine will be separated from the fibrous matters. The product of gelatine thus obtained is run in thin films on to a smooth surface of slate or other suitable material to set; it is then removed on to nets to dry, and when dry it is cut up with an isinglass cutter or other suitable apparatus.—*London Journal of Arts and Sciences.*

2nd Order of CHONDROPTERYGII, Cuv.
Gills Attached.

Branchiæ pectinated, apertures numerous, without orpiculi or membranes; palatine and postmandibulary bones, armed with teeth in place of jaws, pectorals and ventrals always present, the males have long appendages at the internal margin of the ventral fins.

Family—SQUALIDÆ, SHARKS.

Body elongated, tail thick, fleshy, pectoral fins, moderate; branchial apertures in the sides of the neck; eyes lateral; snout more or less produced; mouth and nostrils beneath.

> Increasing still the terrors of these storms,
> His jaws horrific armed with three fold fate,
> Here dwells the direful shark.—*Thomson.*

Sharks are ferocious and gluttonous; nothing seems to be rejected by them; living as well as dead matter is greedily swallowed.

The mouth of this ferocious animal is deep, and the opening often three or four feet in diameter, so that it is capable of swallowing animals, etc., of a large size. Some authors assert that it was a shark and not a whale that swallowed Jonah (?)

The teeth are long, sharp and triangular, with projections and serratures on the sides, arranged in a series of transverse rows, and looking backwards, (the white shark has more than two hundred lying on each other in rows, almost like the leaves of an artichoke); they form such a perfect cutting apparatus, that being moved by very powerful muscles, scarcely any edible substance can resist their action.

Pennant had one tooth rather more than an inch and a half long.

Grew says that those in the jaws of a shark two yards in length are not half an inch, so that the fish to which this tooth belonged must have been more than six yards long, provided the teeth and body keep pace in their growth.

A master of a Guinea ship informed Mr. Pennant that a rage for suicide prevailed among his new-bought slaves, from a notion the unhappy creatures had, that after death they should be restored again to their families, friends, and country. To convince them at least that they should not reanimate their bodies, he ordered one of their corpses to be tied by the heels to a rope and lowered into the sea; and though it was drawn up again as fast as the united force of the crew could be exerted, yet in that short space the sharks had devoured every part but the feet, which were secured at the end of the rope.

An officer states—When the midshipmen had caught a shark, they pulled him up in their boat, cut open his belly, and then sent him back to the water. His body was instantly attacked by those nearest to him, and so on by all the others at a distance, as they came up on the disturbance, and was torn to pieces by them. The experiment was repeated with the same result.—*United Service Journal.*

Dr. Mosely says a shark twelve feet long was caught in Kingston Harbour, (1780) and on its being opened, the entire head of a man was found in his stomach. Mr. Hughes, in his "Natural History of Barbadoes," states:—The sailors of the ship "York Merchant," having discharged her cargo of coals, ventured into the sea to wash themselves. They had not been long in the water before one on board espied a shark making towards them, and gave them notice of their danger; upon which they swam back, and all reached the boat except one. Him the monster overtook almost within reach of the oars, and griping him by the small of the back, soon cut him asunder, and as soon swallowed the lower part of his body.

As the "Karnak" was leaving the port of Nassau, a pilot fell overboard from her boat, in which he was being towed. The ship was stopped, and the boat instantly left for his rescue, while two life-buoys were thrown from the ship. The boat got close enough to give him the end of an oar, which he took, and cried "For God's sake, save me!" The men were about to haul him into the boat, when he was carried down by a large shark which came up at the moment, taking the oar with him.—*Illustrated London News, April 14th*, 1860.

A few days after the fatal accident, a shark was captured in Nassau harbour, and on being opened, the pilot's right hand and wrist, with a portion of his shirt, (by which the hand was identified) a goat's head, with horns nine inches long, and a turtle's head, were found in his belly. The hand, &c., have been given to the poor fellow's relative—*Cumberland Pacquet.*

A human body, almost in an entire state, has been found in the stomach of a shark. *Rondelet* says that some have been taken at Nice and Marseilles, and men entire, (nay, one man all in armour) have been found in their stomach. *M. Muller* states that one was taken off the island of St. Margaret which weighed 1,500, and that the stomach contained the whole body of a horse, which had probably been thrown overboard from a ship. *Cetti* says, one was caught in a tunny net, weighing 300 or 400 lbs., in which were eight or ten tunnies. In the stomach of one captured in the Alceste was found the baskets, shavings, cordage, ducks, hens, and buffalo hide, &c., which had been thrown overboard that morning.—*Capt. Hall's Fragments.* One was taken near the Isle of May, in the Firth of Forth, which contained in its stomach a tin canister, which, upon being opened, was found to be nearly filled with old coins! *Sir John Barrow* found in the stomach of one (10 ft. 8 in. long) the complete head of a female buffalo, a whole calf, a quantity of entrails and bones, and large fragments of the upper and under shells of a considerable turtle, &c.

Some of the species are viviparous, and others oviparous. In Norway the skin is employed for ropes, harness, &c.; in Greenland, for making and covering canoes; in Europe and America it is is used for polishing by the carver, carpenter, &c., covering boxes, spectacle, spyglass, and watch cases.

SHARK CHARMERS.

Many divers will not venture to descend until the shark charmer is on the bank, and has secured the mouths of the sharks; while some are provided with a written charm from their priests, which they wrap up in oilcloth perfectly secured from the water, and dive with it on their persons. Others, being Roman Catholics, appear satisfied with an assurance from their priest that they have his prayers for their protection. But I am informed they are all happy to secure the interest of the shark charmer, who is paid by the government, besides being allowed a perquisite of ten oysters from every boat daily during the fishery. These empirics have all the resolute audacity of their trade. They maintain their power with the most impertinent eloquence, and, should a shark happen to give the lie to their pretensions, they are ready with the most ingenious excuses; and so complete is their ascendancy over the credulity of the divers, that an accident from a shark never awakens the slightest mistrust of the power of these impostors to keep them off.—*Pearl Fishery of Ceylon.*

During the time of the fishery the shark charmers stand on the shore till the boats return in the afternoon, muttering prayers, distorting their bodies into various strange attitudes, and performing ceremonies. All this time they ought to abstain from food or drink, but they sometimes regale themselves with toddy till they are no longer able to stand at their devotions.—*Capt. Percival.*

The Land Shark, as described by *Bishop Earle*, a distinguished English divine, born at York in 1601, consecrated Bishop of Worcester in 1662, died in 1665.—A shark is one whom all other means have failed, and now he lives of himself. He is some needy, cashiered fellow, whom the world hath flung off, yet still clasps again; and is like one a-drowning, fastens upon anything that is next at hand. Among other of his shipwrecks, he has lost shame; and this want supplies him. No man puts his brain to more use than he, for his life is a daily invention, and each meal a new stratagem. He has an excellent memory for his acquaintance; though there passed but how do you do betwixt them seven years ago, it shall suffice for an embrace, and that for money. He offers you a pottle of sack out of joy to see you, and in requital of his courtesy you can do no less than pay for it; he, fumbling with his purse-strings as a schoolboy with his points when he is going to be whipped, till the master, weary with long stay, forgives him. When the reckoning is paid, he says it must not be so; yet is straight pacified, and cries what remedy? His borrowings are like subsidies, each man a shilling or two as he can well dispend, which they lend him not with a hope to be repaid, but that he will come no more. He holds a strange tyranny over men, for he is their debtor, and they fear him as their creditor. He is proud of any employment, though it be but to carry commendations, which he will be sure to deliver at eleven of the clock. They in courtesy bid him stay, and he, in manners, cannot deny them. If he finds but a good look to assure his welcome, he becomes their half-boarder, and haunts the threshold so long till he forces good nature to the necessity of a quarrel. Public invitations he will not wrong with his absence, and is the best witness of the sheriff's hospitality. Men shun him at length as they would do an infection, and he is never crossed in his way if there be but a lane to escape him.

He has done with the age as his clothes to him; hung on as long as he could, and at last drops off.

GENUS—SCYLLIUM.—CUV.

Snout short, obtuse; nostrils opening near the mouth, continued in a furrow, extending to the edge of the lip, and more or less closed by one or two cutaneous lobules or membraneous flaps; spiracular apertures; teeth triangular, with lateral denticles at the base; dorsal fins placed much behind; caudal fin elongated, not forked, truncated at extremity, branchial apertures partly above the pectoral fins.

Dr. Johnston observes:—It may here be noticed that both the herring and haddock fishings sometimes suffer very considerably from the ravages of dog-fish. These pirates are seldom abundant when the herrings are in a compact body; but not unfrequently they occasion great destruction when a shoal is first drawn in near land. The havoc they make is such, that they have been found to consume a dozen barrels out of one boat's nets in the course of an hour. They also are very destructive to the nets when they get entangled. By their efforts to get free, their hard fins tear the nets. There is reason to think that they also use their teeth for this purpose. In like manner, they make sad work among the haddocks. Occasionally half of those that take the hook have only the head left when they reach the boat. Sometimes the tail is stumped away; sometimes a bite is taken out of the belly; and at other times out of the back. A codfish sometimes comes up a mere skeleton, stripped to the bone on both sides.

Remains of the dog-fish have been found in the stomach of the frog-fish, (Lophius piscatorius, Linn.)

S.—CANICULA, CUV. SMALL-SPOTTED DOG-FISH. COMMON.

The ovum (called sea-purse, mermaid's purse, &c.,) is an oblong, four-sided, flattened, horny case, from three to five inches long, with the angles extended into long filamentary tendrils, which attach themselves to the stems of algæ, growing in rock pools, and at low-water mark, &c. Bar-point, &c., common.

S.—CATULUS, Cuv. Large-Spotted Dog-Fish. Common.

The ovum of this species similar in shape and tendrils to the last described, and about two-thirds smaller.

Genus—CARCHARIAS, Cuv.

Snout prominent, conical, depressed, nostrils beneath the middle; teeth in many rows, flat, pointed, cutting, often denticulated on their margin; no spiracles; first dorsal fin before the ventrals, and the second nearly opposite the anal fin; the last of the branchial openings over the pectoral fins.

C.—GLAUCUS, Cuv. Blue Shark. Not Uncommon.

This fish is a great plague to the fishermen, cutting their lines without apparent reason, or running along the whole length of a pilchard drift net, cutting out as with shears the net and the fish it contains, and swallowing both together. When it cannot escape from the hook upon which it is caught, it has a curious method of rolling up the whole line upon its body, so as almost to preclude the possibility of getting it off.—*Couch.*

Genus—GALEUS, Cuv.

Body elongated; head rather long; snout produced; pointed, temporal orifices; teeth pointed, serrated on their exterior side; first dorsal fin nearly above the pectoral fins.

G.—VULGARIS, Cuv. Common Tope. Not Uncommon.

Genus—Notidanus, Cuvier; Haxanchus, Rafin; Sq. griseus, Lin.; Sq. vacca, Schn; Le griset, Rafin. *Description.*—Ash-coloured above, whitish beneath; and very remarkable for its *six branchial openings*, and for its teeth, which are triangular above, and serrated below. The snout is depressed, and rounded like that of the shark.—*Cuvier.*

A specimen of this rare shark, measuring two feet two inches, was caught at Polperro.—*Falmouth Packet*, June 28th, 1846.

Genus—MUSTELUS, Cuv.

Body elongated; snout blunt, with temporal orifices; teeth flat, like those of the skate; dorsal fins unarmed.

M. lævis, Flem. Smooth Hound. Not uncommon, In the Hebrides it is used as food, and esteemed a very delicate fish.

GENUS—LAMNA, CUV.

Snout pyramidal, with the nostrils at the base; teeth flat, triangular, smooth, sharp, numerous, in rows; branchial apertures large, before the pectoral fins.

L. Cornubiensis, Cuv. Porbeagle or Beaumaris shark. Scarce. Seventeen quarts of oil were obtained from the liver of one. This shark pursues its prey in packs; and this habit, as well as a slight resemblance to the porpoise, it has acquired the name Porbeagle.

GENUS—SELACHUS, CUV.

Body elongated; head small; snout short, blunt, with temporal orifices; branchial apertures large, extending nearly across the neck; teeth small, conical, without dentitions, numerous; first dorsal fin nearly between the pectoral and ventral fins.

S. maximus, Cuv. Basking Shark. August 9, 1858.—One of the driving boats brought in a fine specimen, which had rolled itself up in one of the nets. It weighed 300 pounds, and measured eight feet in length. January 3, 1808, one was captured at Penryn. It was 31 feet long, 8½ feet high, 19 feet round the mouth, 5½ feet wide, extent of tail 6 ft. 9 in.. and weighed eight tons. The liver produced 198 gallons of oil.

Mr. J. Osler stated (in his lecture delivered at the Polytechnic Hall, Falmouth, September 30, 1859,) that the skin was set up and exhibited through the country; and the owner made it his dwelling, using the mouth for a door, living in the belly, and sleeping in the tail.

GENUS—ALOPIAS, BONAP.

Upper lobe of the caudal nearly as long as the body; cutting edges of the teeth smooth; branchial apertures small.

A. vulpes, Cuv. Fox Shark. Scarce. The flesh is reported to be tolerably good, and not very unlike veal. It not unfrequently dashes among a herd of dolphins or porpoises, which are sporting about in fancied security, and puts them to flight by a smart blow of its tail, hence perhaps its name thrasher.

Genus—ACANTHIAS, Riss.

Snout elongated, blunt at the end; teeth small, edged, in many rows; a strong spine before each dorsal fin; no anal fin.

A. vulgaris, Risso. Picked Dog-fish. Not uncommon. This species, says Dr. Fleming, swarms on the coast of Scotland, where it is taken, split, and dried, and is a food among the common people. A good deal of oil is annually obtained from the livers of this species.

Genus—ECHINORHINUS, Blainville.

The first dorsal fin opposite to the abdominal ones; teeth large, broad, and low, the edge nearly horizontal; the lateral edges have one or two transverse denticles; skin covered with spinous tubercles.

E. spinosus, Blain. Spinous Shark. Rare. Taken in a trawl net belonging to Mrs. Chard, a few miles from the harbour, December 6, 1849. Length seven feet, breadth two feet; weighed 200 pounds.

Dr Smith says:—This shark is described by fishermen as sluggish and unwieldly in its movements, and but seldom to be observed towards the surface of the water. When they obtain specimens, it is generally at a time when they are fishing in deep water, and when the bait with which the hooks are armed is near the bottom.—*Zoology of Southern Africa.*

Genus—SQUATINA, Dumeril.

Body broad, flattened horizontally; head round; mouth at the extremity of the muzzle; eyes on the dorsal surface; temporal orifices; pectoral fins large, extended forward, separated from the neck by a deep cleft, in which are the openings of the gills; dorsal fins behind the ventrals; no anal fin; caudal fin with one lobe above and the other below the extremity of the tail.

S. angelus, Dum. Angel fish. Not uncommon. From the supposed resemblance of the pectoral fins to wings, the animal has acquired its name angel fish. Mr. Pennant mentions a fisherman whose leg was terribly torn by a large one of this species which lay within his nets in shallow water, and which he went to lay hold of incautiously.

Archestratus, (a tragic poet, whose pieces were first acted during the Peloponesian war,) speaking of the fish of Miletus, gives this the first place, in respect to delicacy, of the whole cartilagenous tribe.

Family—RAIIDÆ, RAYS or SKATES.

Body much flattened, resembling a disc; eyes and spiracles on the back; nostrils, mouth, and branchial openings on the under side; sides bordered by large pectoral fins; dorsal fins generally placed upon the tail.

Ray derived from the Anglo-Saxon *Reoh*—rough.

Genus—TORPEDO, Dum.

Body smooth, depressed, obtuse before, and nearly circular; anterior border formed by production of the snout, which extends along the sides to meet the pectoral fins; five branchial openings on each side, beneath; *electrical organs* on the sides; teeth small, pointed, sharp; tail thick, fleshy, without spines; caudal rather large.

> The hook'd torpedo ne'er forgets its art,
> But soon as struck begins to play its part,
> And to the line applies its magic sides:
> Without delay, the subtle power glides
> Along the pliant rod and slender hairs,
> Then to the fisher's hand as swift repairs:
> Amazed he stands; his arm of sense bereft,
> Down drops the idle rod; his prey is left:
> Not less benumb'd, than if he'd felt the whole
> Of frost's severest rage beneath the Arctic pole.

Oppian.—British Zoology.

The electrical organs are two in number; large, flattened, and kidney-shaped bodies placed in the space between the head, the pectoral fins, and the branchiæ, reaching from the dorsal to the abdominal surface, and covered by the integuments of the body. They consist of a series of small, vertical, hexagonal cells, (in appearance like honeycomb) which are filled with mucous matter, and abundantly provided with nerves.

Professor Owen states that each organ derives this supply from one branch of the trigeminal, and from four branches of the vagal nerves, and the four anterior nerves are each as thick as the spinal chord; the last nerve is a feeble branch of the vagus. The trigeminal and vagal enlargement of the olivary and restiform tracts coalesce on each side, forming the so-called electric lobes of the medulla oblongata. The electric branch of the fifth nerve may be defined even at its origin from the true ganglionic part of that nerve; and *Professor Savi* affirms that both this and the vagal branches consist entirely of the primitive nerve-fibre of animal life, or a double contour, and that they are distributed by successive resolution into smaller and smaller fasciculi until they finally penetrate the septa of the columns and terminate thereon by meshes formed by loops or by the return and anastomosis of the terminal elementary nerve-fibre. The number of cells varies according to the size of the fish; thus, in each organ of one fish were counted 470, and in another very large fish 1,182. This natural electricity can be drawn from it by means of a conductor, and a shock is felt through a circuit formed by several persons joining hands. The animal possesses the power of giving shocks at pleasure.

M. Matteucci (the eminent electro-physiologist) has forwarded to the French Academy of Science an account of experiments which he says prove that "the electro-motive power of the organ of the torpedo exists independently of the immediate action of the nervous system; that this power notably augments, and persists for a long time in this augmentation, when the nerves of the organ have been excited several times successively, so as to obtain a certain number of successive discharges; and that it is independent of the nature of the gaseous medium in which the animal has been left during twenty or thirty hours."—May, 1860.

T. vulgaris, Cuv. Torpedo or cramp-fish. Very rare. One from trawl boat in the autumn of 1845. A young live specimen was taken in a trawl net, August 1852; in the possession of Dr. Vigurs.

T. nobiliana, Bonap. New British torpedo. Arthur Chard, fisherman, caught a fine specimen with hook and line, a few miles from the harbour, September 5, 1845. Length, 3 feet 2 inches; breadth, 2 feet. Skin was sent to Mr. Yarrell. December 2nd same year, he procured a second example, length, 4 feet. Skin in the possession of A. Fox, Esq.

Chard and one of his men suffered severely for two or three hours in their hands and fore arms, on an attempt being made to haul into the boat the first fish.

Risso has characterised four species in his "Histoire Naturelle del Europe Meridionale." T. narke, Riss. Eyed cramp-fish. Body reddish-yellow above, with five oscillated spots of an azure blue, changing to grey, each surrounded with a broad brown circle; under surface greyish white; *spiracles toothed;* eyes black.

T. unimaculata, Riss. Single spotted cramp-fish. Body fulvous above, spotted with whitish starlike points; an oblong, oscillated blue spot, with reflections, encircled with grey, on the middle of the back; front of the head festooned; *spiracles not toothed,* but large; tail slender, roundish; eyes reddish. T. marmorata, Riss. Marbled cramp-fish. Body flesh-coloured above, with brown spots and wavy stripes; under surface reddish-white, edges as it were carved; *spiracles toothed;* tail flattened, ending in a round fin; tail thick, rounded. T. galvani, Riss. Galvani's cramp-fish. Body fulvous above, immaculate, edged with black; under surface white, tinged with red.

The T. marmorata, Riss., is considered by the Rev. Dr. Fleming to be the same as that found in the British seas; but Mr. Yarrell states that the name of the British species is yet doubtful.

GENUS—RAIA, CUV.

Disc rhomboidal, very much depressed; five branchial openings on each side, beneath; mouth below; tail slender, with two small dorsal fins near the extremity, and sometimes a rudimentary caudal; teeth small, *flattened*, *lozenge-shape*, crowded.

The ray has a peculiar cartilage arising from the nasal part of the skull, and extending to the anterior part of the crest of the pectoral. *Muller* and *Heule* state that it is found in all the ray tribe.

R. mucronata, Couch. Long-nosed skate. Not uncommon. Distinguished not only by the great length of nose, but also by the distance between its most extreme point and the transverse line of the mouth. The ovum of the skate is an oblong, flattened, (horn-like) case, with the angles produced forwards and backwards, like those of a butcher's tray, common.

R. oxyrhynchus, Montague. Sharp-nosed skate. Not uncommon. The snout is very long, but narrower than in R. mucronata; the lateral margins in a moderately-sized fish running nearly parallel to each other for three or four inches at the extremity. Dr. Johnson says I have measured one which was seven feet nine inches in length, and eight feet three inches in breadth. About 40 years ago I examined one caught with hook and line at Hope Cove, near the Bolt Head, Devon, that weighed 500 pounds.

R. bates, Linn. Skate. Not uncommon. A female specimen was caught by a party on board of the cutter "Ellen,"' belonging to W. Carne, Esq. It weighed 120 pounds, and measured five feet six inches.

A man at Wick, the other day, purchased a large skate, and on opening it discovered in the stomach a box of patent congreve matches, warranted to ignite in any climate.—*Illustrated London News*, April 7, 1860.

R. miraletus, Linn. Homelyn ray. Not uncommon.

R. spinosa, Rond. Sandy ray. Not uncommon.

R. clavata, Rond. Thornback. Common.

GENUS—TRYGON, ADONS.

Head joining with the pectorals to form an obtuse angle; teeth slender, set in quincuncial order; tail slender, destitute of fins, armed with a serrated spinous point; body smooth.

Circe (daughter of Sol and Perseis, celebrated for her knowledge in magic and venomous herbs,) armed her son *Telegonus* with a spear headed with the spine of the *Trygon*, as the most irresistible weapon she could furnish him with, and with which he afterwards unintentionally killed his father in the island of Ithaca.

T. pastinacea, Cuv. Sting ray. Scarce. The flesh is said to be rank and disagreeable. The liver is large, and yields a great deal of oil.

The spine is renewed annually; sometimes the new one appears before the old one drops off, in which state it is the *Cardina Trilost* of the Cornish fishermen.—*Dr. Fleming.*

ORDER—CYCLOSTOMI.

Jaws fixed in an immovable ring; branchiæ fixed, and the openings numerous.

GENUS—PETROMYZON, DUM.

Body elongated, cylindrical; skeleton soft; maxillary ring armed with strong teeth; lips, formed for suction; tongue with two rows of small teeth; seven branchial openings on each side of the neck; a dorsal fin before, and another behind the anus; no pectoral or ventral fins.

These fishes fix themselves by suction to stones, (so great is the force of adhesion exerted, that a stone has been raised out of the water weighing 10 or 12 pounds) and other solid bodies; they attack the largest fishes in the same way, and are finally able to pierce and devour them.

P. marinus, Linn. Great or sea lamprey. Pennance, Mainporth, &c. The flesh of the lamprey is white, fat, soft, tender, and agreeable to the taste. Dr. Fleming says—When in season it is esteemed delicious. Henry I. was preparing for a journey, but was seized the 1st December, 1135, with a sudden illness at St. Dennis le Forment, from eating too plentifully of lampreys, a food which always agreed better with his palate than his constitution.

Most of the wealthy Romans kept them in fish ponds at a great expense. *Vedius Pollio*, the friend of Augustus, who distinguished himself as much by his eloquence and writing, as by his savage gluttony—on the supposition that lampreys fed on human flesh, were more delicate, ordered his *slaves*, when accused of the slightest faults, to be thrown into his fish-pond. This cruelty was discovered when one of his servants broke a glass in the presence of Augustus, who had been invited to a feast. The master ordered the servant to be seized, but he threw himself at the feet of the emperor, and begged him to interfere, and not suffer him to be devoured by fishes. Upon this the causes of his apprehension were examined, and Augustus, astonished at the barbarity of his favourite, caused the servant to be dismissed, all the fish-ponds to be filled up, and the crystal glasses of Pollio to be broken to pieces. *C. Herius's* fish-pond was sold for £32,291 13s. 4d., and the fish of *Lucullus* for the same sum. Hortensis and Crassus, celebrated orators, had a most extraordinary attachment to this fish; one of them shed tears on the loss of a lamprey, the other wore mourning at the death of his favourite. *Pennant* states that it has been an old custom for the city of Gloucester annually to present the sovereign with a lamprey pie covered with a raised crust.

Henry First, according to Robert, of Gloucester,
" ———— willed of a lampreye to ete,
But his leches, (physicians,) him vorbede vor yt was a feble mete.

Henry IV granted protection to such ships as brought over lampreys for the royal consort. Henry V. issued out a warrant to William of Nantes for supplying him and his army with lampreys wheresoever they happened to march.

P. fluviatilis, Jenyns, River Lamprey, Helford, etc. In course of one season, as many as 40,000 have been sold as bait for turbot, cod, etc., at 40s. per 1000. Formerly the Thames alone supplied from 1,000,000 to 120,000 lampreys annually.

GENUS—AMMOCÆTES, DUM.

Body soft, membranous, branchial openings, seven on each side of the neck, upper lip semi-circular, covering only the upper part of the mouth, opening of the mouth furnished with branched cirri; dorsal fins united to the caudal one, forming a low and sinous ridge.

A. branchialis, Cuv. Common Pride. Near Strongess, Swanpool, etc.

GENUS—GASTROBRANOHUS, BLOCH.

Maxillary ring membranous, with a single tooth above; tongue, with two rows of teeth on each side; mouth circular, surrounded with eight cirri; branchial openings two, under the abdomen.

G. cæcus. Bloch. Glutinous Hag. Rare. The myxine or hag feeble and helpless, as the casual observer might suppose it, is in reality one of the most formidable assailants with which the larger fishes have to contend, since neither strength nor activity avail aught in defending them against a foe, apparently so despicable: fixing its mouth firmly to the skin of its comparatively gigantic victim, the myxine bores its way into its flesh by means of its dental apparatus.—*Professor Owen.* It enters the mouths of fishes caught in the lines of the fishermen which remain a tide under water, and eats up the fleshy parts of their bodies, leaving only the skin and bones. Providence has enabled this creature to protect itself from its enemies by the slime it secrets from the surface of the body. This is so abundant that *Peter Kalen* having put one in a large tub of sea-water, it became like a clear transparent glue, from which he could draw threads, even moving the animal with them.

GENUS—AMPHIOXUS, YARRELL.

Body compressed, pointed at both ends, dorsal fin extending the whole length of back, and passing round the tail, no pectoral or ventral fins; mouth narrow, elongated, margin furnished with a row of slender filaments.

A. lanceolatus, Yarrell. The Lancelot. Scarce. I consider the fish scarce in our neighbourhood; not a rare one. Its rarity arises from the naturalist being ignorant of its habitat, and selecting ground for his dredging operations, incompatible with the movements of the fish.

ADDENDA.

1859.—*January*.—Deilepila Galii, Och. The caterpillar of this moth was found by a lad near Kimberly Place, in the possession of Master C. Philips.

October 24th.—Cypselus Alpinus, Selby. Alpine Swift, was shot by R. A. Daniel, Esq., at Mylor, near Falmouth. In the possession of E. H. Rodd, Esq., Penzance.

1860.—*January*.—Deilepila Galii, Och. The caterpillar was found by Mrs. Wood on a branch of the fuchsia coccinea, in her garden, Penwerris Terrace, Budock. In the possession of Miss Vigurs.

March 28.—Testacella Maugei, Feruss. Found by Mr. John Jackett in his garden. In the possession of W.P.C. This makes the seventh specimen obtained in Falmouth during the last nine months, it may therefore be considered indigenous in this locality.

April 25.—Mr. Jackett informed me that he had recently, in turning up the ground, procured more than 40 specimens in his garden, situated in rear of Mr. Tilly's house near Erisey Terrace.

Limnoria terebrans, Leach. In submerged wood, common.

Chalura terebrans, Allman. Ditto ditto ditto.

September 7.—Fourteen wigeon (*Mareca Penelope, Steph.*) left Penryn river for the sea about half-past six o'clock in the morning.

September 12.—A very large flock of starlings (*sturnus vulgaris*, Linn.

Eight or nine curlews (*Numenius arquata*, Lath.,) left Penryn river between the hours of eight and nine a.m., and crossed the harbour for St. Mawes.

October.—*Testacella Maguei*, Fer. Four specimens, alive, were found in a garden near Grove Hill, by Samuel Gill, gardener. In the possession of Miss Vigurs.

Puffinus major, Temm. Caught with a hook and line, Penryn river. In the possession of Mr. Jenyns, Penryn.

November 1.—*Acipenser sturio*, Linn., was caught by the men belonging to the "Dart," trawler, of Falmouth. Measured eight feet in length, five feet seven inches in circumference, and weighed four and a half hundredweight. Sold in the Falmouth market for 4½d. per pound.

November 2.—*Nycticorax Gardennii*, Genel. Shot by a St. Mawes man. Mounted by Mr. P. Chapman.

November 17.—*Harelda glacialis*, Leach. It was stated in the *Falmouth Packet*, that a female specimen of this very rare duck had been shot near Tregothnan, Truro river.

On some recent Modifications of Opinion respecting the Origin of Crystalline Rocks, and their bearing on the more important points of Practical and Theoretical Geology.

By Henry Curwen Salmon, F.G.S.

The various important and laborious enquiries which, of late years, have been undertaken by numerous eminent chemists, mineralogists, and geologists, for the purpose of investigating the genesis and metamorphism of crystalline rocks, have led to some extensive modifications of the hitherto ordinarily received opinions on these subjects. My purpose here is to lay briefly before you a statement of the results of some of the more important of these investigations, which, it seems to me, cannot fail to be of particular interest in this county, where such rocks are so abundant.

The first and most obvious deduction resulting from the study of the rocks forming the earth's crust, is that they are roughly divisible into two leading classes. 1st. Rocks evidently *stratified* occupying a major portion of the surface of the earth; and 2nd. Rocks *not* evidently *stratified*, with a structure more or less crystalline, also occupying large areas, but not such extensive ones as those rocks that are obviously stratified. From the earliest period when the science of geology can be said to have had an existence, there has been no essential difference of opinion as to the mode of origin of the first named class of rocks. All have admitted that they were of sedimentary formation, derived from the *debris* of pre-existing rocks, and deposited from water, although the true circumstances and conditions of the denudation and deposition were for a long time obscured by speculations, which—while admitting their derivative and sedimentary origin —endeavoured to limit the *time* in which the denuding and depositing forces had acted, to very narrow periods. By degrees the lapse of geological time allowed for those operations, has been gradually extended; and the original catastrophes, which were imagined in order to account for their formation in limited periods, have consequently been allowed gradually to become—

"Small by degrees and beautifully less;"

until at length we may take it as now unanimously agreed that sedimentary strata at least have originated from causes, and under conditions, similar to those now in action—by which like deposits are, at the present day, in course of formation in the various oceans, seas, and estuaries which are estimated to cover two-thirds of the surface of our globe.

The origin of the second class referred to—the crystalline rocks—has, however, from the beginning of geology, been a much more disputed point; and even, at the present moment, is so far from being settled, that, as I shall point out further on, we are just now called upon to relinquish all our hitherto most cherished views as to their nature. Every one is acquainted with the rival doctrines of Werner and Hutton. That of Werner assumed granite, and the basaltic and trappean rocks, to have been deposited from water like limestone or clay slate, and differing only in being precipitated from a primitive or chaotic ocean. The essential doctrine of Hutton, on the other hand,—and he seems to have been the first who clearly conceived it—was that the granite, trappean and basaltic rocks had originated *from beneath.* I need scarcely say that the former hypothesis has been long since exploded, and that the Huttonian doctrine, as to these rocks being of eruptive origin, has been incontrovertibly established. But while we admit their eruptive nature, and consequently also admit their plasticity at the time of their eruption, I must guard you against confounding this admission with the popular modern igneous theories, by which it is assumed that these rocks are derived from a molten interior—the residue of a formerly wholly incandescent globe. There are many who by no means accept such a theory; and, for the reasons I shall point out to you further on, adopt an entirely different doctrine as to the genesis of crystalline rocks. Indeed, the rapid growth and wide-spread popularity of the ultra-igneous theories may probably afford an instructive study to some future historian of the inductive sciences, as illustrating the (often unconscious) force of contemporary popular opinion to mould the facts of science into hypotheses consistent with the tenor of our preconceptions; for a little consideration of these theories shows us that they combine the *facts* (facts incontrovertible) of Hutton, with the *philosophy* of Werner. Hutton proved that granite was eruptive; but then he denied that it belonged essentially to any original or primordial condition of things, and refused to admit that, in geology, we can find any traces of a beginning: which, you must understand, no more implies the denial of there ever having been a beginning, than an admission of our inability to trace the origin of the Celtic race could be construed to imply a denial of it ever having had a beginning. The philosophy of Werner, on the other hand, was that we could trace a beginning; and this philosophy suited our preconceived ideas so admirably, that it was championed and successfully maintained by the orthodoxy of Europe against the suspected doctrines of Hutton and Playfair, which had no support but unappreciated facts—a very feeble defence, at times, against such powerful antagonists. The modern igneous theory, however, happily combined the palatable philosophy of Werner—the *mode* of beginning only being altered—with the undoubted facts of Hutton; otherwise I very much fear the latter would not have so soon obtained the general acceptance and great popularity at which they rapidly arrived

The modern igneous school thus started with the philosophy of being able to trace a beginning. This beginning was supposed to be represented by the granite, which was assumed to be the consolidated crust of an originally wholly incandescent globe, and thus to be essentially "primitive."*

* Everyone knows that, taking an average of experiments, as far as we can penetrate below the surface, the temperature of the earth increases about 1° Fah. for every 60 feet. This is, so far, an indisputable fact; but it is a very slender foundation upon which to raise the astounding hypothesis, by which it is seriously maintained that, at a depth of about 30 or 40 miles, the heat would be sufficient to fuse every known substance. If the ancients, with their knowledge of the increase of temperature in the northern hemisphere from the north to the south, but not knowing that it again decreased from the equator, had jumped at the conclusion that the ratio they observed was continuous, and that consequently the extreme southern regions were in a state of incandescence, we should have the nearest parallel to the hypothesis of Cordier.

"———— They say,
The solid earth whereon we tread
In tracts of fluent heat began,
And grew to seeming random forms,
The seeming prey of cyclic storms,
Till at the last arose the man."

This hypothesis of the "primitive" origin of granite, completely accords, you will see, with the Wernerian philosophy of creation, the leading idea of which was the original or primitive formation of this rock; although the two schools differed certainly as to the mode of origin—one attributing it to the cooling of an originally incandescent globe, and the other to a deposition from a chaotic ocean. It need not be a matter of surprise that this hypothesis which with our then imperfect knowledge of geology seemed to be consistent with observed facts, should have obtained great popularity; for it had the immense advantages of being perfectly logical (that is consistent with itself), and of presenting a distinct and striking picture to the public mind, into which it has sunk so deep that it is no easy matter to eradicate it —for there are even yet some generally well-informed persons who still imagine all granite to be essentially primitive. I need scarcely tell you that such is not the case. By the investigations of Studer, von Buch and Elie de Beaumont, it was shown years ago that granite was of more recent formation than secondary strata; but since then it has been found to have been formed as recently as the tertiary epoch; and so far from being essentially "primitive," it is doubtful whether there exists any granite mass of which we cannot clearly prove an origin subsequent to some sedimentary formation. This is the case with the granite range of Cornwall and Devon, which is ascertained to have originated subsequently to the coal measures.*

* When this doctrine, of the non-primitive origin of granite, was first promulgated, Göethe, in some well known lines, jestingly compared it to high treason:—

Wie man die Könige verletzt
Wird der Granit auch abgesetzt
Und Gneiss, der Sohn, wird zum Papa;
Auch dessen Untergang ist nah . . . .

At present, as Naumann says, the dethronement of granite is a *fait accompli*, and without the hope of a restoration; although we still sometimes meet with a geological Rip van Winkle who gives a cheer for the Primitive Sovereignty of his Granitic Majesty.

But, besides rocks of evidently sedimentary formation on the one hand, and those which have been long since admitted to be of equally undoubted eruptive formation (whatever may have been their original source) on the other hand, we have a third class of rocks partaking at once of the character of both. These are the crystalline rocks, usually called crystalline schists, such as gneiss, mica-schist, crystalline marble, and the like, which are at once crystalline and stratified—bearing upon them, in fact, the stamp of a double origin; being frequently as regularly and undoubtedly stratified as any sedimentary deposit, and yet often as well crystallised as granite itself. They are, indeed, frequently found to graduate inperceptibly into both these classes of rocks, between which they seem to form an intermediate link.

The genesis of this class of rocks has hitherto been one of the most obscure problems in geology. The original ultra-igneous view was something to this effect: it imagined that when the originally fluid incandescent earth became covered by the first granite crust, this crust was still at a high temperature, and likewise the ocean about it. The denuding action of this thermal ocean on this granitic crust, only produced, of course, disintegrated granitic matter; which, being thrown down, became quickly consolidated, and even further crystallised by the action of the still heated crust—the sum of the results producing gneiss, mica-schist, and other rocks of that class. This hypothesis necessarily implied an approximative "primitive" origin for these rocks, only subsequent to the primitive granite itself, which it was presumed had been just consolidated.*

* This theory has been very forcibly stated by Sir Henry De la Beche—"If we consider our planet as a cooling mass of matter, the present condition of its surface being chiefly due to such a loss of its original heat by long continued radiation into the surrounding space, that, from having been wholly gaseous, then fluid and gaseous, and subsequently solid, the surface at last became so reduced in temperature, and so little affected by the remaining internal heat, as to have its temperature chiefly regulated by the sun, there must have been a time when solid rock was first formed, and also a time when heated fluids rested upon it. The latter would be conditions highly favourable to the production of crystalline substances, and the state of the earth's surface would then be so totally different from that which now exists, that mineral matter, even abraded from any part of the earth's crust which may have been solid, would be placed under very different conditions at these different periods. We could scarcely expect that

Within recent years, however, this hypothesis has been to a great extent modified even by the most decided advocates of the doctrine of former igneous intensity—while by the majority of geologists, it may be considered as almost abandoned. By the latter it is now generally admitted that these rocks are of *metamorphic* origin—that is, were originally ordinary sedimentary rocks metamorphosed or altered into their present crystalline or semi-crystalline condition by the action of subsequent causes. Those who yet cling to a certain extent to the old hypothesis, do not deny the correctness of this metamorphic doctrine as applied to a portion of the crystalline schists; but they divide these rocks into two classes—the older and newer crystalline schists—admitting for the latter a metamorphic origin, but still claiming for the former an origin immediately subsequent to the original consolidation of the first granitic crust. It cannot be denied that if we accept the theory of original igneous fluidity and subsequent consolidation, we must admit that such a class of rocks would necessarily have been formed immediately after the granite; and so far the upholders of that theory are consistent in maintaining such an origin for what they call the older gneiss.

But among those who accept the doctrine of a metamorphic origin for these rocks, there is by no means any unanimity of opinion as to what *causes* we are to attribute the changes that have occurred; on the contrary, they are ascribed, by different schools of geologists, to the most diverse causes. Hutton (between the years 1788 and 1793) seems to have first clearly conceived the metamorphic origin of crystalline schists, as well as the eruptive nature of granite. Finding both classes of rocks generally associated together, and attributing the original plasticity of granite to heat, he naturally ascribed to heat also the action of metamorphism. Following this view, most others

there would not be a mass of crystalline rocks produced at first, which, however they may vary in minor points, should still preserve a general character and aspect, the result of the first changes of fluid into solid matter, crystalline and sub-crystalline substances prevailing. In the gneiss, mica-slate, chlorite slate, and other rocks of the same kind, associated together in great masses, and covering large areas in various parts of the world, we seem to have those mineral bodies which were first formed."—*Report on Geology of Cornwall and Devon, page* 33.

who have considered the subject have, until comparatively recently, adopted the same view, and attributed to heat *principally* the enormous metamorphic action which we can trace in almost every part of the globe.

But although, as early as the period stated, Hutton clearly conceived the doctrine of metamorphism, it subsequently fell into comparative oblivion, and it was not until between 1820 and 1830 that we find the subject revived in any definite form. About that period, two celebrated theories were proposed; one by the French geologist, Boue, and the other by our own distinguished countryman, Sir Charles Lyell. The first was based entirely on the igneous hypothesis, and ascribed metamorphism to the action of internal heat, aided by gaseous emanations and other similar causes, all originally attributable to the action of the still molten interior.* Where the doctrine of the metamorphic origin of large bodies of crystalline schists has been accepted, this theory of the mode in which this metamorphism was brought about, has been that which, for many years, was most popularly received in the geological world.

The metamorphic theory of Sir Charles Lyell, particularly as developed in his more recent works, was to a great extent different; for instead of attributing the metamorphic action to causes essentially emanating from a still incandescent interior, and immediately due to some contiguous mass of eruptive rock assumed to have been, just before its consolidation, a part of this still incandescent interior, he merely maintained that the altering or metamorphosing causes originated in some action (impossible exactly to define,) existing in the interior of the earth at an un-

* "La chaleur ignée, et les emanations gazeuses de l'intérieur de la terre auraient donné aux schistes peu à peu et sous une plus ou moins forte compression une espèce de liquéfaction ignée. Les elémens des schistes auraient perdu de leur force de cohésion, leurs parties constituantes auraient été écartées les unes des autres, et les émanations gazeuses auraient pu s'insinuer dans les vides ainsi laissés. De cette manière les affinités chimiques auraient pu s'exercer dans certainés limites, posées par les forces adverses de la cohésion, et les parties constituantes des roches auraient pu prendre pendant la liquéfaction et le refroidissement lent un arrangement plus ou moins crystallin suivant les circonstances, et sans déranger ou détruire notablement la structure feuilletée primitive."—*Annales des Sc. Nat.*, 1824, *page* 417.

known depth. So far indeed from attributing metamorphism to the action of a contiguous highly heated granitic mass, representing a portion of the still incandescent nucleus, he suggested that this granite itself may have been merely another result of the same metamorphic action in a higher state of intensity, by which a thorough fusion had been produced.* To the rocks originating from these deep internal metamorphic causes he gave the name of *hypogene* or *nether-formed*, implying that they were essentially formed, and had assumed their present form and structure, at a considerable depth beneath the surface, being subsequently raised and exposed to our view by the elevating and denuding actions so familiar to geologists. But although Sir Charles declined to limit the metamorphic causes, and especially denied that they were necessarily dependent on the hypothesis of a still incandescent interior, he, like Hutton, attributed more to the agency of heat (from whatever cause derived) than seems to be justified by facts ascertained by those more recent enquiries to which I am about to direct your attention.

For a period long subsequent to their promulgation, these metamorphic theories were received with little favour by the scientific world. The Lyellian theory found scarcely any supporters, for it was deemed impossible that any other power in nature, other than central primordial heat still maintaining the interior of the earth fluid, could account for the formation of the crystalline rocks. Even the more orthodox igneous metamorphic theory of Boue found comparatively little favour at first, for it was emphatically denied that the action of contiguous heated masses, even assuming any possible amount of aid from gaseous emanations, was adequate to originate by metamorphism the extent of crystalline schists observed.† This objection to the

* Compare Manual of Elementary Geology, 5th Edition, page 603.

† Some of the adverse opinions to the doctrine of metamorphism are curious to read at present. The French geologist Rivière thus disposes of it: "L'opinion, qui regarde le gneiss, les mica-schistes, &c., comme des roches de transition metamorphique, est une *veritable exagèration*; la métamorphisme n'est qu'un accident dans des limites tres étroites." Another eminent French geologist calls it—"La théorie complaisante . . . . la flexible théorie de metamorphisme"

theory in question, as I shall point out to you further on, was perfectly sound, and is indeed shown by our most recent discoveries, to be quite unanswerable; yet it was soon to a great extent abandoned by those who first maintained it. In fact, as soon as it was ascertained that granite was not "primitive," but on the contrary might be of comparatively recent origin; and that many crystalline schists of no very limited extent, were proved to be secondary, and even tertiary strata altered by subsequent actions; it was impossible any longer to deny a considerable power to metamorphism, and then was invented the hypothesis classifying the crystalline schists into New and Old—attributing to the former a metamorphic, and to the latter a "primitive" origin. The line between these was not, of course, very rigid or definite; so that when any crystalline rock originally classed as "primitive," was at any time proved not to be so, it was readily admitted into the metamorphic class, which thus grew, step by step, until, as I have already stated, the great majority of geologists are now willing to include almost all the crystalline schists under that head.

Such, until recently, was the state of opinion on these subjects in this country and France. In Germany there has always existed a school of chemical geologists, who declined to accept the popular igneous doctrines, which they deemed inconsistent with the known laws of chemical affinity. G. Bischof, Scheerer, Fuchs, Schafhautl, and others of this school, have for years contended that a fusion, at a great heat, of silicic acid with the bases (alumina, potash, soda, lime, magnesia, the protoxides and peroxides of iron and manganese, &c.,) which form the principal chemical constituents of the crystalline rocks, *could not*, by any known chemical laws, produce, on cooling, any rock but a felspathic or hornblendic glass or lava, according to the preponderating constituents; that such a mode of origin was *impossible* for rocks containing a large proportion of free silicia acid as

Sir H. De la Beche condemns it as a "sweeping hypothesis." M. Coquand dispatches it as follows :—Eblouis par la théorie séduisante du metamorphisme, les auteurs en ont outré les effets au point de confoundre et d'englober dans une seule et même formation quatre formations géologiques distinctes."

quartz. Like the early promulgation of the discovery of flint remains, or indeed any other opinions which run counter to the popular scientific dogmas of the day, and are not supported by influential leaders in scientific societies—these reasonings received little attention in this country, if indeed any geologist of eminence even took the trouble of becoming acquainted with them either by himself or his coadjutors. As long ago as 1844, Bischof, in a memoir "On the origin of quartz and ore veins,"* demonstrated that these must have originated by processes essentially aqueous, inasmuch as the natural affinity of the silicic acid for the bases precluded the notion of the quartz having been introduced in a molten condition. An extension of these considerations have led to the most recent investigation on the subject, M. Daubree, to declare, as a result of his elaborate experiments, that the quartz which is found under so many forms in eruptive and metamorphic rocks must, as well as that of veins, be considered "*comme un temoin de la voie humide*"†—a conclusion which will at once indicate to you the views which I am about to place before you, as to the causes of metamorphism, and the probable mode of origin of crystalline rocks.

Following out the investigations of the German school of chemical geologists, to whom the full credit of originality is undoubtedly due, and no doubt suggested by them, the subject has more recently been taken up by some of the most eminent chemical geologists of France; the result of which has been to bring it more prominently before the English scientific world than would have been the case if the same results had been confined to publications in a language so comparatively imperfectly known as German. Among these French geologists, MM. Delesse and Daubree, both men of European reputation, have been the most conspicuous by their elaborate memoirs :—*Etudes sur le Metamorphisme des Roches*, by M. Delesse; and *Etudes et Experiences Synthetiques sur le Metamorphisme et sur la Formation des Roches*

* Leonhard und Bronn's Jahrbuch für Mineralogie, &c., 1844, page 257.

† Daubrée. *Etudes et Expériences sur le Métamorphisme.* Annales Des Mines, Tome xvi, page 454.

Cristallines, by M. Daubree.* Both these were published in the *Annales des Mines*, and have since been re-published; as they are thus easily accessible, it appears to me that I shall best accomplish the object I have in view by basing my observations as much as possible on these memoirs, which are thus so readily available for further information. Although these two memoirs cover the same ground, they do not at all clash with, but rather supplement, each other—for each follows an essentially distinct mode of investigation, which makes them doubly valuable. That of M. Delesse is analytical, his conclusions being deduced from a wide examination of ascertained metamorphosed rocks from every part of the globe; while, on the other hand, that of M. Daubree is essentially synthetical (as the title of his memoir indicates,) the conclusions he arrives at being to a great extent founded on laboratory experiments arranged to imitate the actions of nature.

Let us first take M. Delesse's memoir. This although a bulky volume of about 500 pages, is to be considered as only an instalment of what we may expect from the author on the same subject; for it only treats of the simpler forms of metamorphism. In its widest sense, in which it is now generally used, metamorphism may be defined to mean "the sum of the effects of transformation or modification—either in composition or structure—which rocks have undergone, from any cause whatever." This is not the sense in which it was originally used, for when it was first adopted it was only intended to be applied to those changes which *dissimilar* rocks undergo by contact with each other: for instance, the alteration which sedimentary rocks, like clay-slate or limestone, suffer by contact with eruptive rocks, like granite, greenstone, or basalt. This limited sense would now only apply to that branch of the subject which we call *abnormal*, or *special*, or *contact* metamorphism—the metamorphism which occurs on the contact of an eruptive rock with the penetrated rock. To the consideration of this minor branch of metamorphism the present volume of M. Delesse is exclusively confined. The more

* M. Daubree's memoir was crowned by the Institute of France (Academy of Sciences) in the public *Séance* of January 30th, 1860.

important division of metamorphism, now called *normal* or *general* metamorphism, which comprises the more wide-spread changes that have occurred on an infinitely larger scale; which originally was never contemplated, and of whose existence even (much less the enormous extent of its action) we have only recently become aware, is excluded from the scope of M. Delesse's present memoir. With the causes of this normal metamorphism, necessarily occurring at great depths and consequently invisible to us, we are still but very imperfectly acquainted, and indeed we can never hope to investigate them by actual observation; all we can expect is to elucidate their mode of action by a process of inductive reasoning similar to that by which we have solved other geological problems equally removed from our cognizance by the lapse of enormous spaces of time—that is, by a comparison as to how similar, but minor, effects may be brought about by causes within the scope of our observation. For this reason, the minor class of metamorphism mentioned—*abnormal* or *contact* metamorphism—has a greater value than at first sight would seem to be the case; for from the observation of the visible and indisputable effects which it produces, we may gradually advance, step by step, to the explanation of the more complex and widely extended changing actions of *normal* or *general* metamorphism. It is for this reason that M. Delesse has first taken the simpler and less ambitious branch of his subject; which, indeed, is the only method of enquiry consistent with the principles of inductive science, in compliance with the spirit of which it is our duty to investigate and collate every observation of causes within our cognizance which give rise to any alteration, however small or apparently insignificant they may appear.* By

* "Le métamorphisme de contact offre du reste par lui-même un grand intérêt; car il est bien évident et il ne saurait être révoqué en doute. Il s'observe dans un espace généralement très-limité, en sorte que la roche modifiante, la roche normale, et la roche modifiée se trouvent réunies. On voit en même temps l'effet et la cause; aussi est-il possible de remonter de l'un à l'autre et d'expliquer les métamorphoses les plus complexes qui ont été eprouvées par les roches. Le métamorphisme de contact est donc la base naturelle de toute recherche sur le métamorphisme. D'ailleurs, *c'est à l'œuvre qu'on connaît l'artisan*, dit le proverbe, en sorte que son étude doit évidemment jeter du jour sur l'origine encore si obscure des roches éruptives."—Delesse, *Métamorphisme*, p. 8.

conducting enquiries on these principles we may be certain to succeed in founding, on a really scientific and inductive basis, this great branch of geological enquiry, which we have hitherto been content either entirely to ignore, or to attempt to solve by various *a priori* hypotheses, which, with all respect to their authors, really occupy about the same position with regard to the special branch of chemical geology, as the speculations of Woodward, Burnet, or Whiston, held in their day to the more general principles of geological science.

In dealing with the subject of contact metamorphism, let us consider the actions which necessarily occur. In the first place the eruptive rock produces a metamorphism in the penetrated rock; but reciprocally the latter also reacts on the eruptive rock itself. There is thus at once *action* and *reaction;* what Cotta calls *everse metamorphism* and *inverse metamorphism*, or what Fournet characterises by the words *exomorphism* and *endomorphism*. These M. Delesse treats under two distinct heads. First: Of the metamorphism of the penetrated rock by the eruptive rock, to which the principal effects are to be attributed. Second: Of the metamorphism of the eruptive by the penetrated rock, an action which usually occurs in a minor degree.

In pursuing his investigations he found that the eruptive rocks might be classed, according to their observed metamorphic actions, into the following leading divisions:—

1st.—*Lavas* of an incontestably igneous origin, and consequently excluding aqueous lavas. The study of the metamorphic action of these, being a known cause, was particularly useful.

2nd.—*Trappean Rocks*, which he defines as hydrated rocks having for a base a felspar of the sixth system. By its form, and the nature of its dominant alcali, its felspar is always more or less allied to anorthite; and if we consequently call generally all felspars of the sixth system by the name of *anorthose*, the trappean rocks may be called *anorthose* rocks. They include basalt, dolerite, hyperite, euphodite, trap, diorite, amphibolite, greenstone, kersantite, &c.; have usually a base of hydrated felspar; and many of them show a very intimate relation with the lavas with which they are often associated.

3rd.—*Granite Rocks*, containing orthose felspar, and which consequently belong to what may be called the class of orthose rocks. Their principal type is granite; but they also comprise syenite, protogene, porphyry, eurite, minette, and even gneiss. The orthose rocks which contain vitreous orthose felspar, belong to the trachyte family; some of these, such as retinite, perlite phonolite and even obsidian, which are hydrated, produce a different class of metamorphic effects, and are consequently grouped with the trappean rocks.

It would take me entirely beyond my limits to give the merest outline of the elaborate investigations by which M. Delesse traces the action of these various classes of eruptive rocks on those which they penetrate; and I shall consequently merely give a brief summary of the results he arrives at, and refer to his memoir for the details on which he founds his conclusions. In the case of the *lavas*, he finds a decided evidence of strong igneous action at the point of immediate contact of the two rocks; but at a certain distance from the point of contact there is evidence of a preponderating action of water in connection with the heat, producing quartz, carbonate of lime, arragonite, zeolites, &c. In the case of the *trappean* rocks, the metamorphic action is intermediate between that of the lavas and that of the granitic rocks, hereafter referred to. Thus in basalt and certain other trappean rocks, and generally in the case of the hydrated volcanic rocks, effects are produced at the immediate point of contact which may be attributed to heat; but they are limited, and the evidence of the action of water is always infinitely the more important, particularly beyond the immediate point of contact. In the case of greenstone the action very nearly approaches that of the granitic rocks—and in all cases the effect of the metamorphism is very limited in extent. In the case of the granitic rocks, the metamorphism is generally more complex, and extends to a greater distance; in fact, in some cases the alteration of the penetrated rock often partakes of the nature of normal metamorphism, and is rather to be considered as being *associated* with the eruptive granite than as *due* to it. The action of heat is still less evident in the case of this class of rocks; and the metamorphism which results from the contact of granite is never shown particularly at the *immediate* point of contact, but is found to have a pretty equal effect for some distance—often as far as it extends. The frequent association of normal metamorphism near the point of contact of this rock makes it difficult generally to distinguish accurately between it and the abnormal or contact metamorphism, and consequently to discover how far the latter extends; but M. Delesse holds that it must be considered as rather limited, and very far from having that importance which has been attributed to it.

From these well ascertained results, the French geologist draws two sets of conclusions; the first as to the nature and condition of the eruptive rocks, at the period of their eruption, as evidenced by their actions on the penetrated rocks; and the second as to the general power of contact metamorphism as evidenced by the extent of metamorphism undergone by this penetrated rock.

As to the nature and condition of the eruptive rocks, he finds that the evidence justifies him in classifying them into three divisions—*igneous*, *pseudo-igneous* and *non-igneous*, coinciding generally with the three classes of rocks already mentioned—lavas, trappean rocks and granitic rocks. Among the igneous rocks, he includes those which are eminently volcanic, with minerals having a strongly marked characteristic vitreous aspect. Among the pseudo-igneous rocks, reduced to plasticity, he considers, partly by heat and partly by water, he classes the ordinary trapps, basalts, pitchstone and phonolites, having a cellular and even scoriaceous structure, and often found dividing into prisms and spheroids. In the non-igneous class he includes the Plutonic rocks of Lyell, such as granite, greenstone and serpentine, whose structure is devoid of the vitreous aspect peculiar to igneous rocks, and rarely cellular, but generally very compact.

As to the general power of contact metamorphism, or the power of the eruptive rock to alter or metamorphose the rock it penetrates, his conclusions show that it is comparatively insignificant; and that consequently the great actions of metamorphism are not in any respect due to the contiguity of eruptive masses—to whose influence they have hitherto been generally attributed. Eruptive rocks and metamorphic strata are certainly often associated together; but the latter is not due to the former. On the contrary, these very eruptive rocks themselves are, as I shall point out to you further on, probably only metamorphic rocks advanced further in the process of alteration.

We have thus two great principles established, both of which no doubt, will clash rather considerably with the preconceived opinions of many holders of the igneous doctrines of popular English geology. One teaches us that the rock which, above all others, we have hitherto loved to consider as the very type of an igneous production, was really reduced to the state of plasticity in which it existed at the time of its protrusion, not by igneous causes, but on the contrary, essentially by aqueous action, assisted no doubt by pressure as well as chemical, molecular and other causes, associated with a certain amount of heat at some depth below our surface. The other teaches us, even more clearly, that the metamorphosing power of heated masses is insignificant—extending scarcely beyond the point of contact; that the major metamorphosing power which any eruptive rock possesses, is due to the penetration, into the neighbouring rocks, of the fluid matters which it contains, and that even this altering power is comparatively limited, and completely insignificant to account for the great metamorphic changes which we can trace—which we call normal metamorphism—and to which these eruptive rocks are themselves probably due. Well may M. Delesse, in the beginning of his memoir, say, "a mesure que j'avancais dans l'etude du metamorphisme, je n'ai pas tarde a m'apercevoir qu'on avait attribue une importance exageree a l'action de la chaleur."*

* Delesse, *Métamorphisme*, page 10.

Let us now turn to M. Daubree's memoir. The general conclusions he arrives at are essentially the same as those of M. Delesse—from whose nomenclature, however, he differs slightly, giving the name of *Metamorphism of Juxtaposition* to what the latter calls special or contact metamorphism, and that of *Regional Metamorphism* to normal or general metamorphism.

In considering this latter division of the subject, I shall first turn to what may be deemed its first and simplest phase. We frequently find extensive districts of schistose rocks of undeniable sedimentary origin, exhibiting decided evidences of metamorphism, even when it is impossible to discover amongst them the least trace of eruptive rocks. In some districts, where the altering action may be considered to have just commenced, we merely find a minor development of the crystallized silicated minerals—such as felspar, angite, garnet or chlorite;—a development little altering the normal character of the deposit. In other districts we find this metamorphic action advanced a step further, still without obscuring the evidences of the original sedimentary character of the rock—such as in the Silurian and Devonian rocks of the Ardennes, where the shales have been developed into a schist highly charged with microscopic crystals of chlorite, with crystals of felspar, and with innumerable quartz veins;—and the grits altered into quartzite. Such cases as these are particularly valuable, for the altering action has not yet advanced so far, or rendered the general aspect of the rock so crystalline, as to admit the suggestion of any igneous action. Indeed, in many strata, where we find a very considerable development of the silicated minerals which we have been taught to regard as necessarily due to igneous action, the general aspect of the rock has been almost wholly unchanged.* May we not fairly ask, if such a development of these minerals can be generated in the midst of such strata, evidently and undeniably without the action of

* For instance, the well known development of hornblende and augite in the secondary limestones of the Hebrides and the Pyrenees; also in the calcareous blocks of Somma; in the carboniferous formation of the Vosges; in some limestones of the Alps; in all of which cases the original character of the strata is otherwise unchanged.

heat—why may not the same action be pushed further, and the whole mass of strata be changed into these minerals, of which it contains the chemical elements? If in a mass of sedimentary strata, we can trace the genesis of one crystal of felspar, angite, chlorite or garnet, why may not any number be similarly formed, and the mass be converted into a crystalline schist? I shall refer further on to this subject, and now return to M. Daubree's memoir.

The two principal points in this are, the author's experiments, before published in the Annales de Mines, on the action of super-heated water on the formation of silicates; and his researches into the contemporary metamorphism of the Roman works at Plombieres.

In the experiments with super-heated water, the most remarkable results were produced by its action on the natural and artificial vitreous silicates, such as obsidian and glass. These substances were treated in a small quantity of highly heated water—generally not exceeding one-third of the bulk of the solid mass—with the following results:—

Ordinary glass, at the end of a few days, gave two and sometimes three distinct products:—1st. A white and entirely opaque mass, resulting from a complete transformation of the glass, with something the aspect of kaolin; the glass had lost a notable quantity of its weight, about half of its silica, and a third of its alcali, and formed a new silicate of the zeolite family. 2nd. An alcaline silicate which was dissolved in carrying away some alumina. 3rd. Innumerable bi-pyramidal quartz crystals, some attaining the size of two millimetres at the end of a month.

The natural volcanic glass, known as obsidian, behaved in a manner similar to artificial glass. Masses of obsidian, similarly heated, were changed into a grey crystalline product, having the aspect of a fine grained trachyte. Examined under a microscope this showed all the characteristics of crystalline felspar, resembling particularly ryacolite or vitreous felspar; it being known that obsidian approaches felspar in chemical composition.

Similarly, the treatment of kaolin produced a crystalline felspar, with a slight mixture of quartz. Augite and mica were also produced; and common deal converted into pure anthracite. All these results, it must be remembered, being brought about by a very small quantity of water. The ordinary silicated minerals themselves, such as the felspars, augites, and micas, remained unchanged.

It is impossible to over-estimate the importance of the experiments, which show that such a small proportion of water can cause the reformation and crystallisation of silicates at a temperature so far below their point of fusion; and it explains, also, how the same silicates can be crystallised in a succession quite opposite to their relative order of fusibility—which has always been a fatal objection to the pure igneous hypotheses, as in the case of the infusible leucite and the fusible augite of the lavas of Italy.

But the most remarkable phenomenon connected with these experiments—and the one of all probably the most worthy of attention, was that the glass, although it lost a portion of its elements in the process of transformation, still augmented considerably in volume—an augmentation reaching a third of its original volume. This is a subject I shall again refer to.

In the investigations into the metamorphism found to have occurred in the Roman works at the baths of Plombieres, the following facts have been the principal ones brought to light. Under the action of a thermal water, not exceeding 60 or 70 deg. cent., the Roman brickwork, with its calcareous cement, has been, to a great extent, transformed into a crystalline mass, characterised by an abundance of silicates of the zeolite family—particularly apophyllite, chabasite, and harmotome—has, in fact, suffered a regular metamorphism. The following seem to be the special circumstances under which this has occurred. Notwithstanding its extreme solidity, the Roman masonry gives access to the thermal water, either through its pores, or by fissures and cavities occurring in it, aided by the pressure of the water, giving rise to a slow, but continuous circulation or current. Now this water contains a certain per centage of saline matters (silicates of potash, soda, lime, and alumina,)—a very small per centage no doubt, but sufficient to permit their accumulation in notable quantities by the continually renewed and indefinitely prolonged circulation of the water; instancing the power of very feeble causes, if multiplied indefinitely by the aid of time—a power which our most skilful experiments ever fail to imitate. The assemblage of minerals generated in the masonry by this water, recalls in its minutest details, the manner of occurrences of similar groups of minerals in the eruptive rocks, particularly amygdaloidal basalt and trap. "If it were not the difference of colour," says M. Daubree, "it would be even quite possible to confound the pieces of *beton*, charged with zeolites, with the basaltic tuffs in which the same minerals are formed. . . . . Such an identity in the results incontestibly indicates great analogies of origin."*

One of the most important facts revealed by these Plombieres enquiries is that generally but a very small portion of the constituent elements of the new minerals is brought by the water. The principal elements pre-existed in the rock; and obeying seemingly some energetic tendency to crystallization, they seize as it were the first passing mineral necessary, and the new mineral is formed on the spot. Altogether there is a striking analogy between the production of the crystallized silicates in the *beton* of Plombieres, and the formation of the silicates found in numerous metamorphic rocks; such as wernerite, garnet, felspar, and angite in the often scarcely altered limestones; and the staurolite in the argillaceous schists. The production of mica in rocks is not more difficult to understand than that of apophyllite, which is also fluoriferous silicate, in the beton of Plombieres.

If a tepid and scarcely mineralised water can thus, in a short time, cause the production of these crystallized silicated minerals, what might we not expect from the effects of water at a greater temperature, and under a greater pressure, slowly circulating, throughout long geological periods, penetrating large masses of

* *Annales des Mi es*, volume xvi, page 449.

rock? Taken in connection with the results produced by superheated water, they certainly may fairly be deemed capable of producing every crystalline rock we are acquainted with.

M. Daubree next proceeds to examine the circumstances of the association of hydrous and anhydrous silicates; of the occurrence of free quartz in various crystallized silicated rocks and schists, which he considers—"*un temoin de la voie humide;*" of the manifestation of metamorphism near the surface—often to a greater extent than in depth; all of which phenomena he shows are alone to be accounted for by admitting a "*formation par voie humide a des temperatures incomparablement plus basses que le point de fusion.*" In one of his final chapters, he points out the close analogy, both mineralogically and geologically that exists between the eruptive and the metamorphic rocks. When the doctrine of the purely pyrogene origin of the eruptive rocks was in the ascendant, this analogy was made the main argument for attributing a similar origin for the crystalline schists. Now that water must be admitted to play a very important part in the formation of the latter, a similar mode of reasoning from the analogy of the two classes of rocks, must necessarily lead us to attribute an important part to the action of water in the genesis of the eruptive rocks—a conclusion to which we have been already led by other considerations. "If we might emit," says M. Daubree, "an hypothesis on this singular association of water with eruptive rocks at a high temperature, we should be inclined to consider these hydrated masses as a highly saturated (tres epaisse) solution of silicates—a kind of aqueous fusion rendered persistent by pressure."*

So far, I have generally connected the metamorphic action of water with a certain elevation of temperature, which is the

* H. Rose has also reviewed, in his paper in Poggendorf's Annalen (vol. 108, 1859, p. 1 ff) "Ueber die verschiedenen Zustände der Kieselsäure," the various hypotheses of the origin of granite, and his conclusions, like those of Daubrée, lead to a negative of a pure igneous origin, and the recognition of a hydatopyrogene process of formation. He considers that the constituents of granite may have originated in a pre-existing mass under the united influences of water, high temperature and great pressure. Compare, also Scrope and Sorby on the same subject.

general view of it taken by MM. Delesse and Daubree. With the more important metamorphic actions, which take place at a considerable depth, this is, no doubt, almost always the case—for we know that at these depths a certain amount of heat exists. I shall now, however, ask you to go with me a step further, and consider whether it may not be possible that metamorphic action may take place at ordinary temperatures. I mean metamorphic action on a large scale, for that some such action may occur without any sensible intervention of heat is sufficiently proved by the instances I have given of the genesis of crystalline silicated minerals in otherwise unaltered sedimentary deposits. Whether such can be the case or not, is a question of great theoretical importance, for upon its solution depends whether we are bound to admit an original source of heat in the centre of the earth or not. If no large metamorphic action can take place except at a considerably elevated temperature, then it will be essentially necessary for us to assume an *original* source of heat; but if, on the contrary, such an action can take place at ordinary temperatures, although of course much slower and more feebly than at more elevated ones, we may dispense with such an assumption. Once admit that some considerable chemical action may take place in the inorganic crust of our earth at an ordinary temperature, and we have at once a source of heat. This heat in its turn will give rise to more intense chemical action, causing increased heat, and so on until a point is reached where a class of what we may call approximately *ultimate* minerals are formed, which are but slightly liable to alteration, and beyond which the chemical action consequently decreases.

My own conviction is that chemical changes, of a nature to re-arrange the chemical constituents of rocks, and consequently bring about what we call metamorphism, changes which would necessarily give rise to heat, may take place by the agency of water at ordinary temperatures. If such changes took place only on a very small scale, or very near the surface, it is highly probable that the heat would be radiated or dispersed without having been able to stimulate the chemical action which produced it into increased activity. But if the original change took place more vigorously, or at such a depth that radiation would have been very slow, then we might expect a process of action and reaction —of slow chemical action primarily giving rise to heat—of this heat stimulating fresh chemical action producing additional heat, and so on to the formation of the *ultimate* minerals, after which the process might be expected to diminish. I believe that any zealous student of mineralogical and chemical geology will be prepared to accept at least the possibility of such a solution; for the elaborate researches of Bischof and other German chemists of the same school, have clearly proved the enormous changes which not only can be, but have been, effected by the action of water percolating through the earth, at ordinary temperatures, if only time enough is given for its action. What has been effected by M. Daubree, by highly heated water, in a limited time, nature can equally effect by the same fluid at an ordinary temperature, in much more lengthened periods of time. The extent of the water which is absorbed into the interior of our earth—which penetrates to the greatest depths, and percolates into every pore —has been only very recently appreciated; but it must certainly represent a very notable portion of the entire quantity existing on our planet. It is hidden from our sight, which alone can account for the little attention it has hitherto received, and the trifling importance which has been accorded to it by geologists. In this great subterranean sea, which is ceaselessly circulating, nothing is insoluble—not even silica itself—for accurate analyses show this acid to exist in solution in numerous springs. To suppose such a stupendous cause to exist without giving rise to enormous chemical action, seems to me more difficult of conception than it would be to imagine the streams and rivers and glaciers and seas and oceans above ground to run their course for centuries without effecting some physical changes in the surface.

In the inanimate, as in the animate world, there is, in truth, nothing unchangeable. The changes which have taken place, and are now hourly taking place in rocks, by the slow action of chemical and molecular movements, brought about by the permeating water, charged with various and ever changing mineral matters, must now be estimated as infinitely greater than we could, a few years ago, even have conceived. Sir Charles Lyell was the first who succeeded in impressing on us the value of the small every day changes which occur by the mechanical action of water at the surface of the earth. These changes are now held sufficient to account for the greatest geological revolutions (only allowing the necessary time) which less than a generation ago it would have been deemed preposterous to attribute to such puny agencies. In regard to metamorphism we have to learn a similar lesson as to the power of every day aqueous causes, acting in the interior of the earth—causes which, working chemically and molecularly, are as capable of producing the greatest revolutions of metamorphism, as the slow mechanical aqueous causes at the surface are of levelling the Alps or the Himalayas, and carrying their debris to the ocean—if, in the former as in the latter case, only sufficient time is allowed to us.

You must, however, understand, that although I am strongly convinced in my own mind of the greater probability of the heat which we find in the interior of our earth being due to secondary chemical rather than to primary causes, yet that I by no means insist upon the truth of such an hypothesis—and that it has no necessary connection with the doctrines of metamorphism which I have explained to you as expounded by MM. Delesse and Daubree. They, on the contrary, accept the doctrine of an original source of heat in the centre of the earth.* As against such a doctrine, however, I may just refer to the conclusions of M. Delesse himself, which teaches us that the amount of heat associated with the production of eruptive rocks seems regularly

* M. Daubrée speaks strongly on this point. "La production si universelle de roches cristallines dans ces terrains foudamenteaux, concourent avec tout l'ensemble des phenomènes métamorphiqués à faire admettre un refroidissement general dans les parties profondes du globe. C'est un argument des plus positifs à opposer aux partisans exagérés des causes actuelles, qui veulent, avec Hutton, que l'origine de notre planéte se perde dans la nuit d'une période indefinie, pendant laquelle les phénoménes géologiques n'auraient cessé de tourner dans le même cercle."—*Annales des Mines*, vol. 16. p. 474.

to diminish with depth;—a rock like granite, which has been undeniably formed at the greatest depths, showing less evidence of heat than the trap rocks, formed at less depths; the greatest evidences of heat being afforded by the volcanic rocks, which, of all the eruptive rocks, have originated nearest the surface. Such facts seem to me to be inconsistent with the hypothesis of the heat being essentially derived from some internal source; and seem rather to indicate for it an origin due to a chemical action, diminishing instead of increasing below a certain depth:—to a process which would attribute the more highly igneous rocks, such as the lavas, to an origin associated essentially with the *upper portions* of the great metamorphic laboratory, and the trapps and granites to a continually more widely extended although less intense deep lying action, in which the influence of heat would be gradually diminishing.* Such an hypothesis would certainly harmonise best with our knowledge on the subject of metamorphism. It would assume for the eruptive rocks a derivative origin, a doctrine long since advocated by Sir Charles Lyell on *a priori* grounds. This would be assumed to be brought about by (in the first place) the gradual metamorphism of sedimentary rocks by the accumulative power of minute chemical action, principally brought about by the continuous agency of water passing through the earth, holding various mineral substances in solution, but also aided, no doubt, by heat—whether original or secondary it is immaterial to determine†—and pressure. The

* The well known fact that the ratio in the increase of temperature in depth is much less in granite than in the sedimentary rocks seems to confirm this view. That rock being essentially composed of what I have called the *ultimate* minerals, the chemical action might be expected to be less than in those rocks where the processes of metamorphism are in action, however slowly.

† Assuming, as we must do if we adopt the conclusions of M. Delesse, that in the greatest depths of which we have evidence, (the seats of the production of granite,) the heat is not very great, it is evidently immaterial in any practical point of view of the genesis of rocks to decide whether this heat is original or produced by chemical action. This point is only practically important as bearing on the doctrine of progression or non-progression; for if the heat is original, it must be continually, however slowly, decreasing by radiation; while if secondary, it may be assumed as constant on the whole. But as this internal heat, if even secondary, must have existed from the earliest geological eras, it is clear that the consideration of its original course is immaterial as influencing the formation of any rocks at present under our cognizance—that is assuming the heat at great depths, at which granite is formed, to be essentially moderate.

different stages of this process would produce the various metamorphic rocks we observe, from the generally unaltered limestone or slate containing merely a few stray crystals of silicated minerals, to the gneiss bordering on, and passing into, granite. Advancing one step further, we come to the point where the intensity of chemical action becomes so great as to reduce these rocks to a state of plasticity. With this state of plasticity we should have, judging from the result of M. Daubree's experiments, to which I have so particularly directed your attention, *an increase of volume*, and, as a consequence, a state of eruption; and a power capable of producing every geological effort of elevation which we can trace in the history of our globe. Once this state of plasticity shall have ensued, the more intense chemical action, and consequent heat, will be near the surface, producing the lavas and volcanic rocks.

Without pressing this view on your attention as anything more than a highly probable hypothesis, I could yet easily lay before you abundant evidences, derived from the general facts and laws of geology, in favour of its acceptance, if the time at my command allowed me to do so. I shall, venture, however, even at the risk of trespassing unduly on your attention, to refer to one objection which has been brought prominently forward against the doctrine of the internal heat of the earth originating from chemical causes. This objection was, no doubt, originally urged against the theory, originated by Davy, and since supported by Dr. Daubeny, which assumed the interior mass of the earth to consist of an unoxidised mass, portions of which are becoming oxidized by the air and water which descend and come in contact with them, by which heat is constantly generated.* But the objection although urged against this theory, of which, of course, I am no advocate, equally applies to the chemical metamorphic theory I have suggested. It is this—and it has been urged very ably by Mr. William Hopkins, in his article on "Geology," in

* This theory is a good type of all the older geological theories, which always sought for stupendous causes, beyond our experience, ignoring the accumulative power of the every day causes acting under our eyes.

the *Cambridge Essays*—that it is impossible to conceive the continued production of heat by any chemical action for an indefinite period of time; that this heat would necessarily be constantly escaping at the surface into the colder surrounding space, without the waste being supplied; and that no process of the generation of heat has ever been suggested by which such uniform supply could by any possibility be furnished for an indefinite period of time. Mr. Hopkins, describes this as "the great stumbling block of the advocates of non-progression with respect to the physical state of the earth;" and as I wish to put the whole matter fairly before you, I have called your attention to it, although I shall not have time to point out what I conceive to be its fallacies. I may state, however, that such an objection would only hold good in the case of our earth receiving no heat from external sources; or at least a less amount of heat that it radiates into space. But is such the case; can anyone venture to say that the heat radiated by the earth is greater than that supplied from solar sources? I don't think our knowledge enables us to do so; indeed, so far from such being the case, some recent speculations would rather lead us to believe that a certain portion of the heat of the sun is absorbed, as it were, into the earth, and there stored up—probably destined to supply the heat generated, and partially radiated and lost, in the actions of metamorphism.

Addressing as I am, an audience of a mining district, you will perfectly understand me when I call to your attention the notion so popular among miners—of all times and of all nations—that rocks "grow." A conviction so wide spread among a class which, above all others, is brought in every-day contact with the actions and appearances of rocks in the interior of the earth, is worthy of some consideration, no matter how inaccurate may be the language in which it is expressed. To a certain extent, consequently, this notion is not so absurd as it at first sight seems, for the action of water on the mineral crust of the earth may not be inaptly illustrated, by way of a simile, by a comparison of that of the action of the blood in the economy of animal life. The blood, charged with certain organic matters, and with the oxygen it receives at the lungs, penetrates through every ramification of the animal body—causing, in its circulation, a continued change of substance, and a chemical action allied to that of combustion ;—the water permeating the mineral masses, holding other minerals in solution, and generally charged with certain acids, causes an action not wholly dissimilar, although of course on a much less energetic scale. Further, according to the hypothesis I have urged, as the heat of animals is due to combustion arising from chemical combinations caused by the circulation of the blood, so may the heat of the earth be due to a not wholly dissimilar, but of course much less energetic combustion arising from actions caused by the circulation of water. This point, however, I must again remind you is merely suggested as an hypothesis; and is not attempted to be placed on the same footing, and must not be confounded with the established facts of metamorphism. I admit there *may* be some original source of heat in the interior of the earth independent of that caused by chemical metamorphic action, although I deny there is any proof of it, and hold that the balance of probabilities is the other way—our present knowledge rather leading us to believe that the subterranean heat we observe is more probably due to secondary causes, not extending beyond comparatively narrow depths.

I cannot but feel, in laying before you this brief exposition of the new doctrine of the extent of metamorphic action, that I have but inadequately succeeded in conveying the force of the evidences on which it is founded. Scientific evidence, indeed, rarely consists of any one or two striking pictures, such as are capable of easy exposition; it is generally made up of a series of minute facts, each in themselves of small apparent value to a casual observer, but forming together a mass of proof, the force of which never can be brought home to the mind except by such a full knowledge of all the facts, as will bring their accumulative force to bear in creating conviction. To many, who are accustomed to regard rocks as the very types of stability and unchangeableness, such an agent as the gradual action of water underground, must seem utterly insignificant to account for such changes as I have described. I am aware that such feelings must exist, even among scientific men; and I am also aware they are only to be removed by time. It is in human nature to prefer to accept stupendous causes in preference to simple ones. As in the infancy of human society, men were wont to attribute every unusual phenomenon to supernatural causes; so, in the infancy of science, men have ever sought for some grandiose and violent causes to account for the great phenomena of nature. The history of every branch of natural science, physics, astronomy, chemistry, and (above all) geology, teaches us the same lesson; that, in their early stages, causes great and potent beyond our every day experience, causes "mystic, wonderful"—were deemed necessary to account for phenomena, which, as science advanced were proved to be due to the simplest agencies.

The Relative Prosperity of Different Parts of Cornwall, before the Opening of the Cornwall Railway, as shown by the Excess of Births over Deaths from 1855 *to* 1858.

By J. J. FOX, F.S.S., Stoke Newington, near London.

TABLE A.

COUNTY OF CORNWALL.

RATIO OF BIRTHS TO DEATHS IN EACH DISTRICT AND SUB DISTRICT FOR FOUR YEARS, 1855 TO 1858.

	Births to 100 Deaths.	
CAMELFORD		219.40
Boscastle	216.44	
Camelford	220.62	
ST. AUSTELL		193.08
Fowey	204.71	
St. Austell, W.	179.65	
Mevagissey	179.40	
Grampound	229.32	
ST. COLUMB		184.10
Padstow	193.85	
St. Columb, W	176.49	
Newlyn	182.22	
LISKEARD		183.11
Callington	199.76	
Liskeard W	176.41	
Looe	164-41	
Lerrin	171.97	
PENZANCE		172.40
Uny-Lelant	166.67	
St. Ives	201.98	
Marazion	166.41	
Penzance, W.	155.97	
St. Just in Penwith	184.54	
St. Buryan	189.94	
LAUNCESTON		170.79
Altarnun	188.57	
North Petherwin	191.43	
St. Stephen	185.26	
Launceston W.	112.68	
North-Hill	195.44	
BODMIN		167.07
Lanlivery	185.89	
St. Mabyn	178.64	
Bodmin, W	137.48	
Egloshayle	186.27	
REDRUTH		166.67
Gwennap	173.42	
Redruth	171.01	
Illogan, W	153.97	
Camborne	159.69	
Phillack	177.84	
TRURO		161.45
Probus	144.74	
St. Just	161.49	
St. Agnes	163.86	
St. Clement, W	133.21	
Kenwyn	170.27	
Kea	209.85	
HELSTON		153.33
Wendron	174.48	
Helston, W.	126.00	
St. Keverne	130.00	
Breage, W	157.99	
Crowan	172.13	
ST. GERMANS		152.72
Antony, W	140.28	
St. Germans	169.71	
Saltash	158.50	
STRATTON		152.57
Kilkhampton	157.50	
Stratton	137.37	
Week St. Mary	170.00	
SCILLY ISLANDS		144.44
FALMOUTH		140.78
Mylor	159.93	
Falmouth W	120.24	
Penryn	149.73	
Constantine	186.15	

TABLE B.

RATIO OF BIRTHS TO DEATHS.

England and Wales	154.91
South Western Division	154.86
County of Wiltshire	154.90
County of Somersetshire	150.98
County of Dorsetshire	158.14
County of Devonshire	148.02
County of Cornwall	168.94

SUB-DISTRICTS OF CORNWALL.

	Births to 100 Deaths.		Births to 100 Deaths.
Grampound	229.32	Redruth	171.01
Camelford	220.62	Kenwyn	170.27
Boscastle	216.44	Week St. Mary	170.00
Kea	209.85	St. Germans	169.71
Fowey	204.71	COUNTY of CORNWALL	168.94
St. Ives	201.98	Uny-Lelant	166.67
Callington	199.76	Marazion	166.41
North-Hill	195.44	Looe	164.41
Padstow	193.85	St. Agnes	163.86
North Petherwin	191.43	St. Just	161.49
St. Buryan	189.94	Mylor	159.93
Altarnun	188.57	Camborne	159.69
Egloshayle	186.27	Saltash	158.60
Constantine	186.15	Breage, W	157.99
Lanlivery	185.89	Kilkhampton	157.50
St. Stephen	185.26	Penzance, W	155.97
St. Just in Penwith	184.54	Illogan, W	153.97
Newlyn	182.22	Penryn	149.73
St. Austell, W	179.65	Probus	144.74
Mevagissey	179.40	Scilly Islands	144.44
St. Mabyn	178.64	Antony, W.	140.98
Phillack	177.84	Bodmin, W	137.48
St. Columb, W	176.49	Stratton	137.37
Liskeard, W	176.41	St. Clement, W	133.21
Wendron	174.48	St. Keverne	130.00
Gwennap	173.42	Helston, W.	126.00
Crowan	172.13	Falmouth, W.	120.24
Lerrin	171.97	Launceston, W	112.68

EXPLANATION.

The Registration County of Cornwall is divided into fourteen Districts, which are generally the same as the Poor Law Unions. Each district is subdivided into two or more Sub-districts, excepting the Scilly Islands, which are undivided. Reckoning them as one, Cornwall consists of 55 Sub-districts.

These Tables represent the proportion that the total births registered during the four years 1855-58, bear to the deaths during the same period. The deaths are supposed to be 100 in each case. In Table A, the Districts are placed in the order in which they stand in this respect; Camelford having the largest proportion of births to deaths, and Falmouth the least. The Sub-districts follow the Districts to which they belong. Those containing the Workhouse belonging to the Poor Law Union are marked with W; it is important to distinguish these, for although the births are unduly increased by this circumstance, the deaths are still more augmented, and consequently the ratio is made less favourable. It will be observed that those marked with W, always stand lower in the scale than their adjoining Sub-districts.

In Table B, the Sub-districts are arranged in order, those with largest proportion of births to deaths, at the top; those with least, at the bottom;—the figure for the whole County is placed among them, to indicate the average value. I have added for comparison, the ratio derived from the same four years, in England and Wales, in the South Western Division of England, and in each of its five component Counties.

Ratio of Births to Deaths as a Test of Prosperity.—It is clear that the proportion of births to deaths, depends on two particulars.

In the *first* place, it depends on the number of deaths, *i. e.*, the mortality of the population, which is, of course, different in different localities.

Secondly, it depends on the number of births. But the number of births is almost entirely in proportion to the numbers of the people living at prolific ages.

In two populations, similarly *distributed* as regards age and sex, the number of births will vary very slightly. What then causes a greater or less proportion of the people to consist of those of young and middle life? It is the amount of employment in the district;—in other words the social prosperity.

Increased employment rapidly attracts the young from neighbourhoods where work is scarce or inadequately paid, and concentrates them on the more profitable fields. On this account the ratio of births is an index of social prosperity.

The proportion of births to deaths is, therefore, made up of *two* elements; it is highest when social prosperity coincides with low mortality or favourable sanitary state;—it is *lowest*, when together with high mortality, there is an unfavourable state of trade, or want of employment. During the four years, 1855 to 58, no particular epidemic, such as cholera, prevailed; and therefore the differing mortality of different districts will depend on their ordinary sanitary state. This varies, but there is reason to think that it does not vary to anything like the same degree that the employment of a district varies. For this reason, the error is not great in regarding the figures of these tables, as indices of the prosperity of the respective localities.

Remarks.—The peculiar interest in such a collection of figures at the present time, consists in the county being just now in a transition state. Its industry, which for the last few years, has laboured under great disadvantages, has received a sudden stimulus. These figures record the social state of the various parts of the County, *for the four years that preceded* the opening of the Cornish Railway. They will furnish a very interesting basis of comparison with similar figures obtained a few years hence, when facility of locomotion has had time to expand and develope the trade of the County.

It is for those who have the local knowledge, to comment on these figures; without it, a writer is in danger of attributing them to entirely erroneous causes.

That the Sub-districts of St. Austell, St. Columb, and Liskeard stand so high, in spite of their containing the Workhouses of their respective Unions, speaks greatly in favour both of their prosperity and their sanitary state. The Sub districts of Helston, Falmouth, and Launceston, stand in sad contrast, indicating either a very unhealthy state, or else that their death-lists are swelled by an *unduly* large proportion of paupers sent into them from their affiliated parishes. This is a very probable circumstance; only those locally informed can say whether it is so.

The high standing of the fishing villages is striking; for instance, Fowey, St. Ives, Padstow, and Mevagissey, in spite of abundant sanitary defects, which are obvious to any one who visits them. The mining districts seem to take an intermediate position; neither very high, nor very low. This may be explained by the two causes counteracting each other; prosperity due to an abundant supply of work, being balanced by the high mortality which Mr. Couch, in his contributions to the Polytechnic transactions, has shown to prevail.

The contrast between the figures for Cornwall and Devonshire in Table B, is great and rather unexpected. The latter must either be less healthy, or have less industrial prosperity than the former; perhaps both. The absence of the mining and fishing industries must make a very great difference in their social state.

The writer hopes that these lists may suggest interesting considerations, in a County Meeting like that of the Polytechnic Society, which brings together so many, well acquainted with the peculiar circumstances of their respective towns and parishes.

TABLE No. 1.

Meteorological Summary of the Weather at Helston, in Lat. 50° 7′ N., Long. 5° 18′ W., for the year 1860, *From Registers kept by M. P. Moyle, Esq.*

1860.	MONTHLY MEANS OF THE BAROMETER. Cistern 106 feet above mean sea level.																				
Month.	Mean pressure corrected to 32° Fahr.			Mean of monthly means.	Mean Correction for diurnal range.	True mean of monthly means.	Mean force of vapour.	Mean pressure of dry air.	Mean range of means.	Mean daily range.	Corrected absolute maximum observed.	Day.	Corrected absolute minimum observed.	Day.	Extreme range for the month.	Greatest range from 9 a.m. to 9 p.m.	Day.	Greatest range in any two consecutive 24 hours.	Between which days it occurred.	Least range in any two consecutive 24 hours.	Between which days it occurred.
	9 a.m.	3 p.m.	9 p.m.																		
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.		in.		in.	in.		in.		in.	
Jan	29.610	29.588	29.628	29.609	.004	29.605	.284	29.321	.274	.176	30.395	7	28.731	24	1.664	.610	25	+.918	24 & 25	+.002	7 & 8
Feb	30.038	30.066	30.055	30.053	3	30.050	.231	29.819	.185	.135	30.534	14	29.390	26	1.144	.482	12	—.595	18 & 19	0	20 & 21
March...	29.841	29.831	29.853	29.842	7	29.835	.278	29.559	.207	.132	30.557	6	28.739	31	1.818	.749	31	—.856	30 & 31	— 3	26 & 27
April ...	29.926	29.935	29.949	29.937	4	29.933	.270	29.663	.116	.083	30.383	30	29.101	2	1.282	.372	1	+.523	31 & 1	+ 2	3 & 4
May......	29.852	29.861	29.852	29.855	2	29.853	.362	29.491	.160	.102	30.305	21	29.334	18	.971	.264	19	+.454	19 & 20	+ 1	3 & 4
June.....	29.696	29.718	29.729	29.714	3	29.711	.380	29.331	.121	.088	30.260	30	29.183	2	1.077	.194	3	—.354	11 & 12	0	14 & 15
July.....	29.986	29.989	29.992	29.983	2	29.987	.423	29.564	.087	.049	30.352	2	29.627	21	.725	.142	24	—.303	21 & 22	× 1	10 & 11
August.	29.725	29.726	29.715	29.722	4	29.718	.426	29.292	.129	.105	30.107	1	29.264	16	.843	.349	18	—.429	27 & 28	+ 1	8 & 9
Sept.	29.859	29.862	29.867	29.863	4	29.859	.388	29.471	.128	.096	30.295	6	29.378	18	.917	.278	19	—.460	12 & 13	— 2	23 & 24
Oct......	29.972	29.957	29.978	29.969	6	29.963	.380	29.583	.149	.090	30.433	4	29.372	11	1.061	.424	10	—.778	10 & 11	— 2	8 & 9
Nov......	29.718	29.708	29.710	29.712	4	29.708	.296	29.412	.138	.103	30.334	11	29.152	26	1.182	.324	14	+.599	17 & 18	0	1 & 2
Dec......	29.551	29.535	29.543	29.543	3	29.540	.263	29.277	.225	.121	30,260	15	28.597	8	1.663	.316	11	+.695	10 & 11	0	9 & 10
Means...	29.814	29.815	29.817	29.817	.004	29.814	.332	29.482	.159	.107	30.351		29.239		1.112	.375		.580		1	

REMARKS.—0.121 in. should be added to all the readings of the Barometer for its elevation of 106 feet above mean sea level. The Barometer is a standard, having a bore of 0.6 in. in diameter, with glass cistern 3 in. in diameter, whereby the ivory point of the brass scale can, by sight, be brought to a tangent with the surface of the mercury at each observation; the open end of the tube has a ring of platina, as recommended by Daniell, for the perfect exclusion of atmospheric air—the tube was filled in vacuo with mercury of the specific gravity of 13.5—and Mr. Glaisher's corrections have been applied to every period of observation taken from the Philosophical Transactions, Part I, for 1848.

TABLE No 2.

1860. MONTHLY MEANS OF THE THERMOMETERS.

Mo.	Dry and Wet Bulb Thermometers. 9 a.m. Dry.	9 a.m. Wet.	3 p.m. Dry.	3 p.m. Wet.	9 p.m. Dry.	9 p.m. Wet.	Mean of dry Therm.	Correction for diurnal range.	True mean of dry Therm.	Mean of wet Therm.	Correction for diurnal range.	True mn. tem. of evaporation.	Wet Therm. below dry.	Mean temp. of Dew point.	Dew pt. below dry Therm.	Greatest range of dry Therm. from 9 a.m. to 9 p.m.	Registering Thermometers. Mean of all the maxima.	Mean of all the minima.	Approximate mean temp.	Correction for the month.	True mean temperature.	Mean range.	Maximum observed.	Day.	Minimum observed.	Day.	Mean.	Range.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°		°		°	°
Jan..	45.9	44.3	47.7	45.5	44.9	43.1	46.1	.4	45.7	44.3	.3	44.0	1.7	42.1	3.6	9.0	51.5	40.5	46.0	.2	45.8	11.0	56.0	1 & 2	31.0	31	43.5	25.0
Feb..	40.8	38.7	44.6	41.2	40.1	38.3	41.8	.6	41.2	39.4	.4	39.0	2.2	36.1	5.1	9.0	48.0	35.4	41.7	.4	41.3	12.6	54.0	29	28.0	13	41.0	26.0
Mar..	46.8	44.4	48.9	45.6	44.8	43.0	46.8	1.2	45.6	44.3	.7	43.6	2.0	41.4	4.2	13.0	52.4	41.7	47.0	1.0	46.0	10.7	56.0	thrice.	31.0	8	43.5	27.0
April	48.9	45.1	52.2	47.2	46.4	43.7	49.1	2.2	46.9	45.3	1.4	43.9	3.0	40.6	6.3	10.0	55.2	43.1	49.1	1.5	47.6	12.1	64.0	27	30.0	15	47.0	34.0
May.	57.8	53.8	60.8	55.9	55.2	52.6	57.9	2.3	55.6	54.1	2.1	52.0	3.6	49.1	6.5	11.0	63.9	51.2	57.5	1.7	55.8	12.7	72.0	22	41.0	5	56.5	31.0
June	58.4	55.1	60.1	56.1	55.4	53.3	57.9	3.0	54.9	54.7	2.0	52.7	2.2	50.5	4.4	7.0	63.8	52.5	58.1	1.8	56.3	11.3	71.0	17	44.0	5	57.5	27.0
July.	62.8	58.0	65.3	59.6	59.3	56.3	62.4	2.2	60.2	57.9	1.3	56.6	3.6	53.7	6.5	11.0	68.7	54.9	61.8	1.9	59.9	13.8	75.0	2	48.0	19	63.5	27.0
Aug.	60.5	57.1	62.6	58.3	58.4	56.4	60.5	2.1	58.4	57.3	1.4	55.9	2.5	53.9	4.5	9.0	65.2	54.0	59.6	1.7	57.9	11.2	71.0	26	45.0	31	58.0	26.0
Sept.	56.6	54.1	60.8	56.4	54.8	52.6	57.3	1.7	55.6	54.3	1.2	53.1	2.5	51.1	4.5	17.0	64.6	50.7	57.6	1.3	56.3	13.9	74.0	6	40.0	30	57.0	34.0
Oct..	54.6	52.6	57.7	55.0	53.9	52.3	55.3	.8	54.5	53.2	.7	52.5	2.0	50.5	4.0	10.0	60.4	49.2	54.8	1.0	53.8	11.2	65.0	twice.	40.0	8	52.5	25.0
Nov.	47.4	45.3	49.7	47.4	47.2	45.4	48.1	.5	47.6	46.0	.5	45.5	2.1	43.2	4.4	8.0	53.4	43.4	48.4	.4	48.0	10.0	60.0	3	35.0	23	47.5	24.0
Dec..	41.9	40.7	44.8	43.2	42.0	41.0	42.9	.2	42.7	41.6	.2	41.4	1.3	39.7	3.0	10.0	48.9	36.9	42.9	.0	42.9	12.0	55.0	thrice.	18.0	23	36.5	37.0
Mns.	51.9	49.1	54.6	50.9	50.2	48.2	52.2	1.4	50.7	49.4	1.0	48.4	2.4	48.9	4.8	10.3	58.0	46.1	52.0	1.1	50.9	11.9	64.4		35.9		50.3	28.5

Remarks.—The Registering Thermometers are on Rutherford's principle and perfectly accurate. The Dry and Wet Bulb Thermometers were made by myself with every care, and are found to be coincident, very nearly, with a standard Thermometer; where there has been any discrepancy the difference has been correctly noticed and allowed for.

TABLE No. 3.

1860.	WINDS.																															
MONTH.	N.			N.E.			E.			S.E.			S.			S.W.			W.			N.W.			AVERAGE FORCE.				RELATIVE PROPORTION.			
	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	Mean.	N.	E.	S.	W.
Jan.......	3	2	5	1	0	0	4	3	3	3	4	4	3	0	0	4	11	7	7	7	9	6	4	3	2.6	2.5	2.1	2.4	6	5	6	14
Feb.......	7	7	7	8	4	4	0	2	2	0	1	1	3	3	3	1	4	2	5	5	5	5	3	5	2.2	2.4	1.6	2.1	11	5	5	8
March ...	3	5	4	2	1	1	1	0	0	0	1	0	1	4	1	7	6	8	9	8	10	8	6	7	2.3	2.8	1.8	2.3	7	2	5	17
April.....	9	8	10	2	1	1	5	3	4	2	1	0	0	2	2	2	6	3	6	4	4	4	5	6	2.2	2.4	1.4	2.0	12	6	3	9
May	1	0	1	0	0	0	7	6	5	2	2	0	4	1	5	9	17	15	3	4	1	5	1	4	2.5	2.6	1.6	2.2	3	6	11	11
June	1	1	1	1	0	0	2	1	1	0	1	0	6	3	6	7	13	7	8	7	10	5	4	5	2.3	2.4	1.8	2.2	4	2	10	14
July	6	5	7	3	2	2	7	4	2	0	0	1	0	0	0	6	8	5	3	4	6	6	8	8	2.0	2.2	1.0	1.7	10	5	4	12
August..	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	6	7	6	10	11	18	13	11	5	2.2	2.6	1.8	2.2	5	0	5	21
Sept.......	8	8	10	2	0	1	4	7	5	1	1	1	1	1	2	5	7	5	5	3	3	4	3	3	1.8	2.2	1.3	1.8	10	6	5	9
Oct.	1	4	3	0	0	0	3	3	3	1	2	1	4	3	4	6	9	6	5	4	11	11	6	3	2.1	2.5	2.0	2.2	6	4	8	13
Nov.......	1	1	1	9	3	1	8	13	13	3	3	3	3	1	3	0	3	3	3	5	3	3	2	3	2.3	2.5	2.1	2.3	5	14	5	6
Dec.......	7	2	5	6	8	6	4	5	4	4	4	4	2	1	2	1	6	4	6	2	3	1	3	3	1.9	2.1	1.8	1.9	9	9	6	7
Sums......	47	43	54	34	19	16	45	47	42	17	21	15	28	20	29	54	97	71	70	64	83	71	56	55	264	292	213	253	88	64	73	141
Means...		48.0			23.0			44.7			17.7			25.6			74.0			72.3			60.7		2.2	2.4	1.8	2.1	7.3	5.3	6.1	1.2

1860. Month.	Average Cloudiness. 9 a.m.	3 p.m.	9 p.m.	Means.	No. of dry days.	No. of wet days	No. of days observed.	Amount of rain in cubic inches.	Mean weight of vapour in a cubic foot of air.	Mn. addl. weight required for saturation of the air.	Mean force of vapour.	Mean degree of humidity saturation = 1·000.	Mean weight of a cubic foot of air at its respective pressure.	Mean degree of dryness of the atmosphere.	Mn. amt. of water in a vertl. col. of the atmosphere.	Moffat's Ozonometer. 9 a.m.	9 p.m.	Means.	Days in which more than a quarter of an inch fell.	Remarks.
								in.	grs.	grs.	in.	in.	grs.	o	grs.					
Jan.	7.0	6.6	5.7	6.4	4	27	31	6.04	3.29	0.43	0.284	0.884	538.29	3.6	3.93	3.0	1.9	2.4	4, 5, 11, 14, 18, 19, 20, 23, 26, 29	Thund. and Lightg. 1; lightg. 21; earthq. 13; hail 6, 21, 22.
Feb.	4.4	4.7	5.5	4.9	13	16	29	1.74	2.69	.52	.231	.839	551.63	5.1	3.19	2.3	2.1	2.2	11, 26.	Snow 1, 10, 11; hail 2, 8, 11, 12, 20, 27, 29 lunar halo 3; gale 19, 26, 27.
March.	6.9	6.1	5.0	6.0	9	22	31	2.46	3.30	.41	.278	.890	542.58	4.2	3.84	4.8	4.0	4.4	1, 11, 23.	Hail 21, 24; gale 14, 23, 31; honeysuckle in leaf 13; lilac 18; horse chestnut 27.
April.	4.8	4.7	4.2	4.5	19	11	30	1.17	3.11	.76	.270	.803	543.73	6.3	3.73	2.6	2.0	2.3		Thund. sm. 1; hail 1, 21, 22; pear in bloom 1; black plums and nectarines 3; apple 28; hawthorn in leaf 4; earthq. 25; cuckoo 28.
May.	5.9	4.7	6.6	5.7	14	17	31	3.69	4.29	.82	.362	.838	531.51	6.5	3.62	2.6	2.1	2.3	9, 10, 16, 19, 25, 30, 31.	Fog 10, 11, 12, 13, 31; lilac in bm. 14; laburnum 15; horse chestnut 16; hawthorn 17; thunder 27.
June.	7.2	6.6	7.3	7.0	7	23	30	4.87	4.31	.69	.380	.862	529.72	4.4	5.25	3.2	2.4	2.8	1, 2, 11, 22, 24.	Fog 19; wheat in ear 18; in flower 26; comet 25 Thunder 28.
July	5.2	5.4	5.4	5.3	21	10	31	1.86	4.75	1.16	.423	.803	528.81	6.5	5.84	2.5	2.1	2.3	13, 20, 21, 27.	Fog 14; sun eclipsed 18; lightning 27.
Aug.	6.5	6.9	7.3	6.9	14	17	31	4.43	4.80	.78	.426	.859	528.85	4.5	5.89	3.0	2.6	2.8	2, 13, 15, 18, 21, 24. 25, 29.	Fog 8, 19, 25; black plum 11; wheat cut 16; oats 17: peach ripe 19; gale 28.
Sept.	5.9	5.6	5.1	5.5	19	11	30	2.78	4.39	.73	.388	.857	531.60	4.5	5.37	2.0	1.7	1.8	14, 17, 21, 26.	Fog 16, 20, 21, 22; gale 26.
Oct.	7.3	7.0	6.2	6.9	13	18	31	2.71	4.32	.62	.380	.873	534.69	4.0	5.26	2.4	2.0	2.2	10, 15, 24.	Lunar halo 3; Aurora Borealis 4; last swallow 12; fog 6, 14, 30; woodcock 22; gale 18.
Nov.	7.7	6.9	6.9	7.1	13	17	30	4.24	3.40	.56	.296	.858	538.04	4.4	4.09	1.9	1.5	1.7	16, 20, 22, 26, 27, 28, 29.	Gale 5, 6, 14, 21; Thunder storm 27; hail 28.
Dec.	5.7	6.6	5.8	5.9	11	20	31	6.97	3.04	.34	.262	.899	540.96	3.0	3.66	2.2	2.0	2.1	1, 2, 4, 6, 8, 10, 19, 23, 24, 26, 29	Hail 19, 20, 22, 25; snow 18, 20, 22, 23; thunder storm 19; lightning 18; fog 31.
Means.	6.2	5.9	5.9	6.0	157	209	366	42. 96	3.81	.65	.332	.855	536.67	4.8	4.47	2.7	2.2	2.5		

Remarks.—The Rain Guage is on Howard's principle, 5 feet from the surface of the ground, and perfectly free from any local effects. Wet days include fog and snow. The dew point, weight of vapour in a cubic foot of air, humidity, &c., are deduced from the tables in the Greenwich Meteorological Observations for 1847. The corrections for the diurnal ranges of the barometer and thermometers are from Glaisher's tables: and in all the calculations, and adjustments of the instruments, a strict adherence has been given to the directions of the Astronomer Royal and the Committee of Physics of the Royal Society.

Meteorological Register for Bodmin, in 1860.

BY LIEUT. LIDDELL, R.N.

Lat. 50° 29′ N., Long. 4° 40′ W. Height above the sea 300 feet. Rain Guage above the ground 3 feet.

Month.	Max. of Bar.	Min. of Bar.	Max. of Ther.	Min. of Ther.	Aver. of Ther.	Rainy Days.	Greatest rain fall in one day.	Monthly fall of Rain.	Bodmin average of rain.	Average of rainy days.	Remarks.
	ins.	ins.	deg.	deg.	deg.		inches.	inches.	inches.		
Jan.	30·20	28·28	56	29	42	27	21st 0·64	7·76	5·40	23	
Feb.	30·58	29·15	50	27	38	14	27th 0·31	1·73	2·44	16	
Mar.	30·58	28·77	54	28	44½	24	4th 0·72	4·17	3·39	16	
April	30·24	28·85	56	32	46½	15	1st 0·34	1·55	3·14	15	
May	30·28	29·30	70	43	55½	18	17th 0·60	3·47	2·95	15	
June	30·13	28·97	65	46	55	29	3rd 1·62	8·49	3·54	15½	Temp. 6½ below that of 1859.
July	30·35	29·40	65	46	59	14	21st 0·49	2·22	3·02	16	
Aug.	30·05	28·99	66	49	56	26	16th 1·24	7·58	3·36	17	Temper. 7 below that of 1859.
Sep.	30·30	29·15	62	41	53	13	15th 0·92	3·60	3·01	13½	
Oct.	30·40	29·22	60	42	51	23	11th 0·89	3·51	5·17	21	
Nov.	30·35	29·00	58	34	42	16	22nd 0·78	3·94	4·46	19½	
Dec.	30·20	28·20	53	14	39	22	30th 1·20	8·31	4·89	21½	·87 of snow fell.
					48½	243	Rain fall in 12 days. 9·75	56·33	44·77	209	

Total fall of rain in 1860, 56·33 inches.

Days with rain, 243.

Average number of rainy days, 209.

Greatest fall in one day, June 3. 1·62 inches.

Average fall of rain in Bodmin, 44·77 inches.

Fall per diem in 1860, 0·1570.

Extremes since 1849 { Greatest fall in 1852, 59·64 inches. Least fall in 1854, 33·15 inches.

Average temperature of Bodmin in 1860, 48½°.

Remarks.—Up to 1859 the largest rain fall registered in Cornwall was at Bodmin, but in the past year the Rev. D. Clements has registered 67·05 inches at Warleggan Rectory, and Mr. W. Pearse, at Camelford, no less than 68·04 in.

Treasurer in Account with the Royal Cornwall Polytechnic Society.

1860.

Dr.

Receipts.

	£	s.	d.
Balance from 1859	8	2	3
Members Subscriptions, 1860	132	16	0
Arrears	8	13	0
Royal Donations.			
Her Majesty	5	0	0
The Prince Consort	5	5	0
The Prince of Wales	5	0	0
Subscriptions from Mines	27	0	0
Receipts at Exhibition.			
Admission	89	13	8
Sale of Catalogues	13	0	6
Paid for Competition	2	2	0
Rent of Tenements	11	16	0
For use of Hall by County Court	34	13	0
Rent of Hall	51	12	4
Sale of Reports	1	3	0
Drawn from Reserve Fund	40	0	0
	£436	8	9

Cr.

Disbursements.

	£	s.	d.
Society's Expenses.			
Prizes & Premiums paid in Cash	58	16	6
Secretary's Salary	80	0	0
Heard for Reports	30	19	0
Mrs Hopkins's Annuity	20	0	0
Medals	2	8	0
Travelling Expenses	2	9	0
Interest on Loan	13	14	7
Proportion of Postages	6	14	2
Ditto of Printing, Stationery, and Advertisements	8	18	3
Hall Expenses.			
Housekeeper's Wages	5	4	0
Firing, Cleaning Hall, and Sundries	6	16	5
Tonkin	1	11	1
Gas	3	16	4
Insurance, Repairs, &c., per Mr. Johns	9	17	10
Rates and Taxes	4	0	2
Exhibition Expenses.			
Carriage of Models & Pictures, Parcels, &c.	28	9	6
Printing	18	4	11½
Dunstan, Men, Attendance, &c	25	10	0
Advertisements	8	0	0
Postages and Posting	6	10	0
Bullocke	3	0	3
Hocking, Spargo	4	6	6
Refreshments for Judges	2	18	1½
Left unpaid in previous years.			
Report, 1858	30	13	8
Exhibition Expenses, 1859	18	10	2
Medals	15	3	0
Hall Expenses	6	16	7
Balance in hands of Treasurer	13	0	8
	£436	8	9

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	£	s.	d.
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Foster, Miss E., *Lanwithen*	0	10	0
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	£	s.	d.
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Barclay, J. H.	0	5	0
Bastian, H. C.	0	5	0
Batting, Norman	0	5	0
Batting, William	0	10	0
Baynard, James	0	10	0
Baynard, Mrs.	0	10	0
* Bennetts, J. P.	0	5	0
Blake, Miss	0	5	0
Blight, Samuel	0	5	0
Blight, Mrs.	0	5	0
* Boase, Dr.	0	5	0
Borlase, J.	0	10	0
Boulderson, Miss	0	5	0
Bottrall, C.	0	5	0
Bottrall, Miss	0	5	0
Bottrall, Miss Emily	0	5	0
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* Broad, R. R., K.N.L., K.S.M. *Vice President*	0	10	0
Broad, Miss	0	5	0
Broad, R. R., jun.	0	5	0
Broad, William	0	5	0
Broad, Mrs. W., jun.	0	5	0
Brougham, Stephen	0	5	0
Bull, James	0	10	0
Bull, Mrs., *Marlborough House.*	0	5	0
* Bull, M. V.	0	5	0
Bull, Mrs. M. V.	0	5	0
Bullmore, F. C.	0	5	0
Bullmore, Mrs. F. C.	0	5	0
Bullmore, Dr.	0	5	0
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Carkeet, Miss	0	5	0

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Cox, J. B., jun.	0	5	0
Cuttance, E.	0	5	0
Day, Miss Agatha	0	5	0
Devonshire, Josiah	0	5	0
Downing, Joseph V.	0	5	0
* Downing, J., jun.	0	10	0
Downing, J. E.	0	5	0
Dunstan, T., *Constantine*	0	5	0
Earle, F. H.	0	5	0
Edmonds, Stephen	0	5	0
Eden, Captain	0	5	0
Egan, Rev. M.	0	5	0
Evans, D.	0	5	0
Fenwick, Miss	0	5	0
* Fox, Charles, *Trebah*	1	1	0
* Fox, Mrs. C.	0	10	0
* Fox, R. W., F.R.S.	2	2	0
Fox, Mrs. Charlotte, *Tottenham*	0	10	0
* Fox, Miss Anna Maria	0	10	0
* Fox, Miss Caroline	0	10	0
Fox. Joshua, *Tregedna*	0	5	0
* Fox, Alfred, *Vice-President*	1	0	0
Fox, Mrs. A.	0	5	0
* Fox, A. Lloyd	0	5	0
* Fox, Samuel T.	0	5	0
Fox, Howard	0	5	0
Fox, Mrs. R. B., *Roscrow*	1	0	0
* Freeman, John	1	0	0
* Freeman, J. D.	0	10	0
Freeman, Mrs. J. D.	0	10	0
Genn, James D.	0	5	0
* Genn, W. J.	0	5	0
Genn, Mrs. W. J.	0	5	0
Groube, Mrs	0	5	0
Gutteres, Rev. F. E.	0	5	0
Gutteres, Mrs.	0	5	0
Hall, R. T., *Devoran*	0	5	0
Hall, Mrs. R. T.	0	5	0
Hallamore, T.	0	5	0
Hancock, M. E.	0	10	0
Hart, Thomas	0	10	0
Hawke, Miss	0	5	0
Hawkey and Co.	2	2	0

	£	s.	d.
Helligey, J.	0	5	0
Hodges, S., *Secretary*	0	5	0
Hodges, Mrs	0	5	0
Hooper, W.	0	5	0
Hooper, Mrs.	0	5	0
* Horsford, T. M.	1	0	0
Hughes, J., H.M.C.	0	10	0
Hunt, J. H.	0	5	0
* Hustler, J.	0	10	0
Hustler, William	0	10	0
Hustler, Miss	0	5	0
Jacob, A.	0	5	0
Jacob, M.	0	5	0
* Jago, Lieut., R.N., *Hon. Sec.*	0	10	0
Jago, John, jun.	0	5	0
Jago, Thomas	0	5	0
Johns, T.	0	5	0
Kelway, L. C.	0	5	0
Kinsman, Rev. R. B., *Tintagel*	0	5	0
* Kinsman, J. K.	0	5	0
Krabbe, Miss	0	5	0
Lake, Mrs	0	10	0
Lean, W.	0	5	0
Mansell, Miss	0	5	0
Maule, Mrs.	0	5	0
Molesworth, Mrs., *Penmere*	0	5	0
Molesworth, Miss, *Penmere*	0	5	0
Olive, M.	0	5	0
* Olver, Jacob, jun.	0	5	0
Olver, T., jun.	0	5	0
Olver, W. Slade	0	5	0
Peters, Rev. M. N., *Penwarne*	1	0	0
* Pender, W. R. T.	0	5	0
Pender, G.	0	5	0
* Phillips, William	0	10	0
Phillips, Mrs.	0	10	0
Phillips, J. H.	0	5	0
Phillips, R. W.	0	5	0
Phillips, Miss E.	0	5	0
Philp, James G.	0	5	0
Pollard, H.	0	5	0
Renfrey, F. E.	0	5	0
Richards, R. C.	0	10	0
Richards, Miss	0	5	0
Richards, W.	0	5	0
Rickard, Rev. R.F.B.	0	5	0
Robinson, Capt. J. G., R.N.	0	5	0
Roberts, John	0	5	0
Rogers, William	1	0	0
* Rogers, Rev. W., *Mawnan*	1	0	0
Rogers, Hender	0	10	0
* Rogers, R., *Carwinion*	0	10	0

List of Annual Subscribers.

	£	s.	d.
Ross, Captain, R.H.A.	0	5	0
Ross, Mrs	0	5	0
Rule, C.	1	0	0
Saules, Capt., R.N	0	10	0
Selley, W	0	5	0
Sharpe, R	0	5	0
Sleeman, H. A	0	10	0
Squire, Lovell, jun	0	5	0
Squire, Anson	0	5	0
Squire, Miss Bessie	0	5	0
Stephens, J., *Ashfield*	0	5	0
Symonds, J., *Constantine*	0	5	0
Symonds, Rev. J., *Baldhu*	0	5	0
Symonds, G., jun.	0	5	0
* Thomas, F. H	0	5	0
Thomas, W. H.	0	5	0
* Tilly, T. H.	0	10	0
Tilly, Mrs. T. H	0	10	0
Tilly, H	0	5	0
Todd, Brereton	0	5	0
Tonkin, T	0	5	0
Tregaskis, W.	0	5	0
Tregelles, Misses	0	10	0
Tregelles, Misses M. and E.	0	10	0
Trethowan, J.	0	5	0
Tuke, Dr.	0	5	0
Tweedy, E. B., *Treasurer*	0	10	0
Tweedy, Mrs. E. B	0	10	0
Tyacke, Capt.	0	10	0
* Vigurs, R. C., M.B., *Hon. Sec.*	0	10	0
Vigurs, Miss	0	5	0
Vigurs, Miss M.	0	5	0
Vyvyan, Miss C	0	5	0
Wake, Capt., R.N	0	5	0
Warn, W	0	5	0
* Williams, Richard	0	10	0
Williams, Miss	0	5	0
Williams, Miss Emma	0	5	0
Williams, E. W	0	5	0
Williams, J	0	5	0
Willmore, A.	0	5	0
Wodehouse, Capt., R.N.	0	10	0

FLUSHING.

	£	s.	d.
Peter, Miss	0	10	0
Sutton, Miss	0	5	0
Symonds, T., *Little Falmouth*	1	0	0
Warren, Miss	0	5	0

GWENNAP.

	£	s.	d.
* Harvey, Richard	1	0	0
Richards, Capt. Jno.	0	10	0
Rogers, Rev. Saltren	0	10	0
* Williams, J. M., *Pengreep, Vice-President*	2	2	0
* Williams, W., *Tregullow*	1	0	0
Wilton, W. H., *St. Day*	0	5	0

HAYLE.

	£	s.	d.
* Harvey, Nicholas	1	0	0
* Poole, J., jun.	0	5	0
* Punnett, Rev. J., *St. Erth*	0	5	0
* Punnett, Macaulay	0	5	0
Tresidder, W. T., *St. Ives*	0	5	0

HELSTON.

	£	s.	d.
* Grylls, Glynn	0	10	0
* Moyle, M.P.	0	10	0
* Popham, C. W., *Trevarno*	1	0	0
* Rogers, J. J., M.P., *Penrose, Vice-President*	1	1	0
* Vyvyan, Sir R. R., Bart., *Vice-President, Trelowarren*	1	0	0

LISKEARD.

	£	s.	d.
Buller, J. F., *Morval*	2	2	0
* Carew, W. H. Pole, *Antony*	1	1	0
* Couch, Jonathan, F.L.S., *Polperro*	0	10	0
Elliot, Samuel	0	5	0
Glencross, Rev. J.	0	5	0
* Pedler, E. H	0	10	0
Rimell, Rev. E., *Marystowe, Launceston*	0	10	0
* St. Germans, Earl of, *Port Eliot*	1	1	0

PENRYN.

	£	s.	d.
Carnell, J., *Perran*	0	5	0
Coombes, J.	0	5	0
Dyke, Miss, *Carclew*	0	10	0
* Enys, J. S., F.G.S., *Enys*	2	0	0
Geach, W. J.	0	5	0
Gill, T.	0	5	0
Gloyne, R.	0	5	0
Hosken, R.	0	10	6
Hosken, W.	0	5	0
Lanyon, J. R., *Kennal Vale*	0	10	0
* Lemon, Sir Charles, Bart., F.R.S., *Carclew, President*	2	2	0
Sara, N.	0	10	0
Sowell, R.	0	5	0
Mead, J.	0	5	0
Reed, T. W., *Trevissome*	0	10	0

List of Annual Subscribers.

	£	s.	d.
* Rogers, T., *Hon. Sec.*	0	5	0
Rogers, T., jun.	0	5	0
Trenery, George	0	5	0
PENZANCE.			
* Bevan, C. D., *Boskenna, Vice-President*	1	1	0
* Bolitho, T. S.	1	0	0
Branwell, R.	0	5	0
Carne, Miss	1	1	0
* Couch, R. Q.	0	5	0
Davy, R. V.	0	5	0
Davy, Humphrey	0	5	0
* Flamank, James	0	5	0
Henwood, Wm. Jory, F.R.S., F.G.S.	0	5	0
* Pearce, Richard	0	10	0
Renfree, Thomas	1	0	0
Roscorla, John	0	5	0
* Rodd, E. H.	0	10	0
* Smith, Augustus, M.P., *Scilly*	2	2	0
* St. Aubyn, J., M.P., *Vice-President*	1	0	0
Vibert, J. P.	0	10	0
REDRUTH.			
* Basset, J. F., *Tehidy*	2	2	0
* Blee, Robert	0	10	0
* Davey, Stephen	1	1	0
* Davey, Richard, M.P., F.G.S.	1	1	0
Garland, T., *Fairfield*	0	10	0
* Hocking, J., C.E.	0	5	0
Loam, M.	0	10	0
* Magor, J. P.	1	0	0
Reynolds, Charles, *Trevenson*	0	10	0
* Richards, William	1	0	0
* Sims, James	0	10	0
Tregaskis, T.	0	10	0
Tweedy, R. M.	0	10	0
ST. AUSTELL.			
* Drake, Dr.	0	5	0
* Jenkins, Rev. D., *St. Goran*	0	5	0
* Rashleigh, Sir C., Bart., *Prideaux*	0	10	0
* Tremayne, J., *Heligan, Vice-President*	2	2	0

	£	s.	d.
TRURO.			
* Barham, C., M.D.	0	10	0
Barham, Mrs.	0	5	0
Baxter, Mrs. Richard	0	5	0
Bond, W. H.	0	10	0
Brune, Mrs. Mary Prideaux, *Padstow*	1	0	0
Cotesworth, D.	0	5	0
* Carlyon, C., M.D.	1	0	0
Carlyon, Miss H.	0	5	0
Champion, Mr.	0	10	0
Daubuz, Rev. J., *Killiow*	1	0	0
* Falmouth, Rt. Hon. Viscount, *Vice-President*	2	2	0
Gilbert, Hon. Mrs., *Trelissick*	1	0	0
* Gregor, G. W. F.	2	2	0
Gwatkin, Mrs.	1	0	0
* Hawkins, C. H., *Trewithen*	1	0	0
Heard, Edward	0	5	0
* Jago, James, M.D	0	5	0
Jackson, Mrs. F. C.	0	5	0
Learwood, T.	0	5	0
Michell, W.	1	1	0
Netherton, J. R.	0	5	0
* Phillpotts, Rev. T., *Feock*	0	10	0
Polwhele, Colonel	0	10	0
Remfry, Miss	0	5	0
Reynolds, Adml., Sir Barrington K.C.B.	1	1	0
* Roberts, Joseph	0	10	0
Rodd, Rev. H. T., *Gwinear*	0	5	0
Salmon, H. C.	1	0	0
Smirke, E., *Vice Warden of the Stannaries*	2	2	0
* Smith, P. P.	0	10	0
Stackhouse, Miss Emily	0	10	0
Stokes, H. S.	0	10	0
Tregelles, T. S.	0	5	0
* Tweedy, Robert, *Vice-President*	0	10	0
Tweedy, Mrs. W. M.	0	10	0
Vivian, J. Ennis	1	0	0
* Willyams, H., *Carnanton*	1	0	0
Wotton, T. Dewen	0	5	0

List of Annual Subscribers.

SUBSCRIBERS RESIDENT OUT OF THE COUNTY.

LONDON.

Baring, T. G., M.P	1	1	0
Burnard, N. N., 36, *High-street, Belgrave-road, Pimlico*	0	10	0
Bunsen, E., *Abbey Lodge, Regent's Park*	1	0	0
W. Dymond, *New Square, Lincoln's Inn*	0	10	0
Fox, S. L., *Tottenham*	0	10	0
Fox, J. J., *Stoke Newington*	0	5	0
Gurney, S., M.P., *Princes-gate, Kensington*	£2	2	0
Hunt, Robert, F.R.S., *Vice President*	0	10	0
Hunt, Mrs.	0	10	0
Smirke, E., *Vice-Warden of the Stannaries, Cheltenham*	2	2	0
Smyth, W. W., M.A., F.R.S.	1	0	0
Taylor, John, F.R.S., &c.	2	2	0
Taylor, John, jun., *Bayswater*	1	1	0
* Taylor, Rd., F.G.S., *Hon. Sec.*	2	2	0
Trelawny, Sir J. S., M.P., 44, *Hertford-street, Mayfair*	1	0	0

PLYMOUTH AND DEVONPORT.

Boswarba, J	£0	5	0
* Buller, Sir Anthony, *Pound*	1	1	0
Balkwill, A. P.	0	5	0
Hancock, R., *Devonport*	0	5	0
Hearder, J. N	0	5	0
Latimer, I	£0	10	0
Mount Edgecome, Earl of	2	2	0
Scott, Miss M. L., 10, *South Devon Place, Plymouth*	0	5	0
Williams, J. D., 55, *Old Town-street, Plymouth*	0	5	0

Long, J., *Tiverton*	0	5	0
Pease, J. W., *Darlington*	0	5	0
Rundle, W. W., *Liverpool*	0	5	0
Robjohns, W., *Tavistock*	0	5	0
Savory, James, *Exeter*	0	5	0
Tangye, Brothers, *Birmingham*	0	5	0
Trevithick, T., *Parys Mine, near Bangor, N.W.*	£0	10	0
Tucket, Francis Fox, *Frenchay, Bristol*	1	0	0
Vivian, Wm. *Conway, North Wales*	0	10	0
Williams, W., *Topsham*	0	5	0

SUBSCRIPTIONS AND DONATIONS FROM MINES.

Dolcoath, *per Capt. Thomas*	5	0	0
Fowey Consols, *per Major Davis*	2	0	0
Par Consols, *ditto*	3	0	0
St. Ives Consols	1	0	0
South Frances, *per R. R. Broad*	5	5	0
United Mines, *per H. Sims*	5	0	0
West Caradon, *per E. A. Crouch*	2	2	0
Wheal Basset, *Donation per W. Richards*	2	0	0
Wheal Clifford, *per Williams and Son*	5	0	0
Wheal Friendship, *per J. Mathews*	2	2	0
Wheal Seton, *per T. H. Tilly*	5	5	0

ROYAL CORNWALL POLYTECHNIC SOCIETY,

FOR THE ENCOURAGEMENT OF

Science and the Fine and Industrial Arts.

INSTITUTED 1833.

Patroness:
HER MOST GRACIOUS MAJESTY QUEEN VICTORIA.

Vice-Patron:
HIS ROYAL HIGHNESS THE PRINCE CONSORT.

Vice-Patroness:
HER ROYAL HIGHNESS THE DUCHESS OF KENT.

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J. J. Rogers, Esq., M.P.
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Thomas Rogers, Esq.

Secretary:
Mr. Sydney Hodges, Falmouth.

A List of the Premiums and Prizes will be found on the following pages.

LIST OF PREMIUMS AND PRIZES
FOR 1861.

PREMIUMS.

NOTICE.—The Society, in all cases, reserves the power of rewarding each communication in proportion to its merit, or even of withholding the Premium altogether.

Competition not confined to members, or residents in Cornwall.

1. MINE VENTILATION.—The following sums have been subscribed for promoting Improved Ventilation in Cornish Mines:—

Royal Cornwall Polytechnic Society.........	£50
Hon. Mrs. Agar................................	10
John J. Rogers, Esq...........................	10
United Mines Adventurers......................	10
T. J. A. Robartes, Esq., M.P..................	5
Rev. H. Molesworth St. Aubyn..................	5
Augustus Smith, Esq., M.P.	5
C. F. Giesler, Esq............................	5

It has been determined that the amount shall be divided into four premiums as specified below:—

Two premiums, one of £50 and another of £25 (to be further augmented in the same ratio as donations to the funds shall allow), to be given to the agents of the first and second best of the two mines in which, under the circumstances of the case, the ventilation shall be most complete; regard being particularly had to "close ends," and the extent to which effective ventilation is carried from the main natural draughts. The effectiveness of the ventilation, both with respect to the quantity and quality of the air supplied, to be tested in such manner as the adjudicators of the premiums may deem satisfactory. The premiums must be applied for, at least two months before the annual exhibition of the society, and if awarded are to be paid to the adventurers of the mines for distribution by them amongst their agents.

A premium of £10 for the best model, and a premium of £5 for the best plan, for increasing the ventilation of mines, especially in those parts which are difficult to reach by natural ventilation.

The Polytechnic Society offers the above premiums for competition, in the hope of directing attention to the importance of improving the ventilation of the Cornish mines. Tables exhibiting the comparative early decease of Cornish miners, and Papers connected with this subject, have been printed in several of the society's annual Reports, and they shew that working in deep mines is frequently attended with the sacrifice of health and the abridgment of life. The evil appears to arise from the miners often working in a stagnant atmosphere, impregnated with deleterious gases and deficient in oxygen, which is so essential to the preservation of life. Attention should be drawn to the subject, whether the draughts obtained in mines by winzes at a distance from the shaft are in many cases local only, and consisting of circuits of vitiated air.

The larger portion of this fund will be distributed with the view to encourage practical ventilation rather than the discovery of new methods of effecting it, as it is believed that the latter are not so much required as the judicious direction and use of the natural draughts; and, where these are insufficient, the introduction of such mechanical aids as have been already found effective. The machines at present employed are—first, the reciprocating pump, in various forms, for forcing or extracting air; second, fans, rotating at high velocities; third, rotatory air pumps, constructed somewhat on the principle of the rotatory steam engines. The last have been successfully applied in France and Belgium, although they appear to be little known in Cornwall. As these machines require only a slow motion, and give a continuous current of air without changing its direction, they seem well adapted for the ventilation of our mines in those cases where machinery is requisite.

2. DRESSING ORES.—A premium of £20, by the Editor of the *Mining Journal*, and by the Society (or such portion thereof as the judges shall consider suitable), to the originator of improvements in the dressing of ore; such improvements to have been in successful operation for a period of not less than six months.

3. IMPROVEMENT IN MINING.—A premium of £5, by the late Editor of the *Mining Journal*, for the best Paper containing an account of any methods, or plans, practised in any other mining districts, advantageously applicable to the Cornish mines. To be accompanied by the necessary drawings.

Note.—The introduction of improved methods of drawing the ores and rubbish from the Cornish mines appears to the committee to be worthy of attention with reference to this premium.

4. DRIVING LEVELS.—Premiums of £7 7s., £5 5s., and £2 2s., by Charles Fox, Esq., for the best Reports of comparative experiments or trials, made under the eyes of the competitors since Sept., 1855, of the relative expense of driving levels in granite or killas, "working big," and of ordinary height; and of driving others of not less than 6 feet in width, and of proportionate height. The ground shall not be of less hardness than £6 per fathom. The tramming may be reduced to 20 fathoms and the hauling to surface at 80 fathoms, as a standard, the landing to be included in the cost. Experiments in carrying an end 8 feet wide would be more satisfactory than driving one only 6 feet wide, as the advantages or disadvantages of an end 8 feet wide would be more manifest than when it was only 6 feet. Time being as important an element as money in the cost of mining operations, it is desirable that the time spent in driving "wide" and "narrow" levels in rocks of nearly equal hardness should also be stated.

Note.—An end which has a "hulk" or "let go" in some part of it, does not admit of a fair comparison.

5. MINERAL VEINS.—A premium of £2 by the society, and £3 by Sir C. Lemon, Bart., for the most exact account of the phenomena of mineral veins in any mine or district, their dip, direction, variations in productiveness, slides, heaves, &c. The Society being especially desirous of cultivating close habits of observation in our miners, will give prizes for accurately drawn cross sections; for collections of *ore* and *country* in which the relations of one to the other are carefully marked; for drawings and descriptions of any remarkable phenomena observed in lodes, &c.

6. CONSUMPTION OF COAL, &c.—A premium of £5 5s., by John Taylor, Esq., F.R.S., for the most complete and accurate accounts of the quantity of water supplied to the boilers, the number of bushels of coals consumed, and the duty performed by an engine, for a period of not less than six months.

7. WORKING PLAN OF A MINE.—A premium of £5 5s. by the society, for the best working plan of a mine in full work (sections of the lodes not required). The plan to be corrected to some time within three months previous to its exhibition. To be drawn by the person who dialled the mine-workings, not being a professional dialler, of which satisfactory evidence must be adduced.

PRIZES.

AT THE NEXT ANNUAL EXHIBITION, PRIZES WILL BE AWARDED TO MERITORIOUS PRODUCTIONS IN ANY OF THE FOLLOWING DEPARTMENTS :—

MECHANICAL DEPARTMENT.

NATURAL PHILOSOPHY.—CHEMICAL ANALYSIS.—
MECHANICAL AND OTHER SCIENTIFIC INVENTIONS AND IMPROVEMENTS.—
MODELS OF MACHINERY, NOT DISPLAYING INVENTION.—
NAVAL ARCHITECTURE.

Inventions and improvements should be accompanied by accurate models or drawings, and explicit descriptions. The drawings should be on a scale large enough to admit of their being seen when hung against the walls of the room; and all descriptions or communications should be written on foolscap paper, on one side only, leaving 1½ inch margin.

The Society being wishful to encourage excellence of workmanship in the handicraft trades and tools, will place at the disposal of the judges a certain number of prizes to be awarded to apprentices and artizans.

Note.—The society will empower the judges to award a reasonable remuneration for the time and labour devoted by *working men* to the production of any deserving models or machines which may be exhibited by them.

FINE ARTS.

SCULPTURE AND MODELLING.—OIL PAINTING.—WATER COLOURS.—PENCIL, CRAYONS, ETC.—ENGRAVING AND ETCHING.—LITHOGRAPHY.—ARCHITECTURE.—ORIGINAL DESIGNS ADAPTED FOR MANUFACTURES IN SERPENTINE, GRANITE, PORPHYRY, ETC.

Competition in this department is restricted to Amateurs.—For regulations respecting the productions of Professional Artists, see page 8.

Premiums of £1 each are offered for the following subjects :—

1. For the best filled sketch-book from Nature.
2. For the best series of six flowers from Nature, in chalk or pencil.
3. For the best series of six sketches, in water colours, of different rocks, shewing their jointed structure and characteristics.
4. For the best water-colour drawing of any simple object from Nature the natural size.
5. For six outlines of stems and branches of British Trees, on imperial-size paper, giving carefully the forms of leaves and characteristics of stems.
6. For the best series of original sketches of our Cornish Antiquities,—Celtic, Roman, or Saxon.
7. For the best series of six outlines of the human hand or foot, life size, from the cast, or from life; indicating light and shade by the lightness or strength of the outline.
8. For the best shaded crayon drawing of one of the busts in the Polytechnic Hall, full size, or the bust of any well-known character.
9. For the best engraving on wood, or lithograph.
10. For the best series of not less than 12 photographs.

SCHOOL PRODUCTIONS.

PRIZES FOR SCHOOLS, OR YOUTHS UNDER 16 YEARS.

A prize of £1, for the best series of six perspective outlines, with original illustrations.

Prizes of £1, 10s., and 7s. 6d., for the best mechanical drawings.

Prizes of £1, 10s., and 7s. 6d., for the best series of drawings from objects or models.

Prizes of 10s., 7s. 6d., and 5s., for the best water-colour drawings, original.

Prizes of 10s., 7s. 6d., and 5s., for the best pencil or crayon drawings.

Prizes of 10s., 7s. 6d., and 5s., for the best maps.

Prizes of 10s., 7s. 6d., and 5s., for the best specimen of penmanship.

Note.—Plain writing and printing on a sheet of foolscap, will better meet the views of the committee, than the more decorative styles which have been hitherto sent for exhibition.

Prizes of 10s., 7s. 6d., and 5s., for the best series of drawings from objects or models, by boys belonging to National and British Schools.

The conductors of schools in this county are invited to encourage their pupils to compete for the foregoing prizes (also for the premiums for persons under 18 years,) and to prepare other productions for the exhibition, as suitable prizes will be awarded to the most deserving.

Note.—It is required that with respect to the productions of persons under 18 years it may be stated, that each drawing or map is the unassisted work of the exhibitor.

NATURAL HISTORY.

ESSAYS.—LOCAL OBSERVATIONS.—COLLECTIONS OF SPECIMENS, PARTICULARLY SUCH AS ILLUSTRATE THE NATURAL HISTORY OF THE COUNTY.

Specimens sent for competition should be properly arranged and accurately named.

Prizes will be especially given for Monographs of any particular family or large genus indigenous to the county, either in Botany or Zoology, such as the *Gramineæ* or the *Hieraceæ ;* the *Holothuriadæ* or the *Medusæ ;* the *Palmipedes ;* the *Rodentia*, &c., &c.

A premium of £2 2s. for the best Illustrated Journal of Natural History, by persons under 20, on the plan of Mr. Cocks' Medley.

A premium of £1 for the best Calendar of Nature, presenting in a tabular form the comparative view of the dryness or moisture of different years ; exhibiting also the advance of the seasons by the time at which various trees, plants, &c., burst into leaf or flower, taking, of course, the same tree each year. The candidates to be under 18 years of age.

STATISTICS.

Communications in this department should relate to subjects connected with the county of Cornwall.

Lander Prizes, for Competitors under 18 Years of Age.

Charles Fox, Esq., offers to the Society, as long as he continues a member of it, the sum of £4 annually, to be distributed in the respective sums of £2, £1, 12s., and 8s., in four several prizes, for the neatest and most correct maps of some one state, province, or European colony, comprising not less than 400 square miles; or a portion of not less than 100 square degrees of some uncivilized region. These prizes to be called the *Lander Prizes*, in commemoration of those enterprising travellers, Richard and John Lander. The principal rivers, lakes, chains of mountains, line of coast (if any,) and territorial line, should be accurately delineated; and the sizes of the most important cities or towns, with their latitudes and longitudes, should be correctly marked. The maps should be accompanied by the best information (with reference to authority) respecting the great physical features of the country, such as particulars relating to the principal rivers flowing through it; the length of course; breadth at different places; tributary streams, lakes and canals; periodical rise, average fall per mile, and the rapidity of current; the progressive increase of alluvial deposit, and the obstructions which may be opposed to navigation :—the characteristics of the principal chains of mountains in such country; their general direction, height, geological and mineralogical features, more important passes, limits of perpetual snow, and the elevations at which various trees and plants will flourish on their sides; or information respecting the population of its principal towns and cities, with the statistics of their trade and manufactures, or the natural productions of the country, zoology, botany, &c.

It is not expected that each map will be accompanied with information on all the subjects specified: they are named as affording hints to guide the juvenile competitors, and to prompt them to compilation and original research.

FANCY WORK.

Prizes will be given, for the best specimen of Lace-work, Berlin Wool-work, Embroidery, Crotchet, &c.; also, for the best design for pattern for Lace-work or Embroidery.

PLAIN WORK.

Prizes of 7s. 6d., 5s., and 2s. 6d., will be awarded for the best made Linen Shirt, and 10s. by Miss Molesworth for the best pair of Knitted Socks, provided not less than three pairs are sent in, by children under 14.

ESSAYS, SCIENTIFIC PAPERS.

Communications of interest relating to the county, which may be forwarded to the Society, will, if approved by the committee, be printed and circulated with the Society's Annual Report. The authors are allowed twenty copies, or any extra number at the cost of paper and printing.

FREE LOAN OF DRAWINGS, ETC.

A collection of Drawings and Prints, comprising studies from Raphael, and the Lithographs by Harding and others, have been presented to the society by the Misses A. M. and C. Fox, for the purpose of affording good copies to those schoolboys and others who may wish to borrow them. These drawings have been very carefully selected, and it is hoped that their use will tend to prevent the waste of time and the bad taste which are occasioned by using inferior copies.

Persons wishing to borrow any of the above, must be recommended by a member of the society, and may apply at the Polytechnic Hall, or by letter addressed to the Secretary.

The members and friends of the society are requested to contribute to this collection of Drawings and Prints.

REGULATIONS FOR COMPETITION, &c.

Competitors are divided into four classes :—

The FIRST CLASS consists of Members of the Society ; also of persons resident in the county, who pay 3s. to be allowed to compete for prizes. First class competitors are entitled to admission on the first day of the exhibition, at the same time as the members and holders of transferable tickets.

The SECOND CLASS consists of persons of the working orders.

The THIRD CLASS consists of Schools for the higher branches of education.

The FOURTH CLASS consists of Schools for the children of the working orders.

The second, third, and fourth classes may compete for prizes without any subscription, but are not entitled to free admission to the exhibition.

Persons residing out of the county cannot compete for prizes in the Fine Arts, for the Lander prizes, or in School productions, unless they become members of the society.

Two sealed notes should be sent to the Secretary by every competitor, each endorsed on the outside with some distinguishing motto or private mark. One should contain a full description of the article sent, and state the class and department in which it is to compete, the other note should be marked "private," and contain the name and address of the competitor.

Articles sent for competition, and the cases in which they are contained should have the same distinguishing marks as the notes mentioned in the last paragraph.

No person shall be entitled to a prize for any article which has appeared at a previous exhibition, unless some improvement has been made to it.

In the department of the Fine Arts, competitors should be careful to state whether their productions are originals or copies.

It is optional with the judges, either to award a medal, or a sum of money instead of it, according to the following scale :—

First Silver Medal	£7	0	0
Second ditto	5	0	0
First Bronze Medal	3	0	0
Second ditto	1	10	0

Medals only, not convertible into money, can be awarded to patented or registered articles.

Persons who may have medals awarded to them shall not be at liberty to exchange the same for their nominal value in money, unless they have received similar medals at any previous Exhibition of the society.

No competitor may receive more than one medal or prize for similar subjects in the same department at the same Exhibition. (This regulation does not apply to mechanical or scientific inventions.)

No holder of a medal or prize can be allowed to compete for a prize of the same, or a lower value, for similar subjects in the same departments at the *next* two subsequent Exhibitions.

The carriage of all articles sent to the Exhibition must be prepaid, unless permission to the contrary has been previously obtained from the committee.

As much inconvenience has arisen from the late period at which articles have been sent in for competition, it is particularly requested that on all occasions such articles shall be delivered at the Polytechnic Hall *one week* before the first day of the exhibition, that the merit of each article may be better ascertained, and the arrangements facilitated.

RULES FOR MEMBERSHIP.

An annual subscription of 5s. and upwards constitutes membership of the society.

Each member is entitled to a non-transferable ticket, giving admission at all times to the annual exhibition and lectures, for a subscription of 5s.; and a transferable ticket for every additional 5s.; and is allowed to compete for any of the prizes offered by the society.

Annual subscribers of 10s. and upwards are entitled to the society's Reports.

Subscribers, not resident in the county, paying 5s. and upwards annually, or who become life members by paying £5, are entitled to the same privileges as county subscribers of 10s. and upwards annually.

Subscriptions become due, in advance, at Midsummer, and no person is considered a member until his subscription is paid.

PICTURES BY PROFESSIONAL ARTISTS.

The society invites professional artists to forward their works to the exhibition, the carriage of which the society will pay; and as an inducement for them so to do, the Art Union of Cornwall has arranged to select their prizes from the pictures so exhibited.

N.B.—The Exhibition takes place in the Autumn of each year, and notice is given of the exact date some weeks previously.

Any other information respecting the society may be obtained from the members of the committee; or the agents in the county, from whom the reports of the society may be obtained; or from the Secretary,

Mr. SYDNEY HODGES, Falmouth.

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POLYTECHNIC SOCIETY.

ESTABLISHED A.D. 1833.

THE TWENTY-NINTH

ANNUAL REPORT

1861.

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PRESENTS TO THE SOCIETY.

Portrait of J. Taylor, Esq., F.R.S., presented by his Sons.

American Journal of Science (Silliman's), 1860-61. By the Editors.

Artizan, 1861. By the Editors.

Journal of the Society of Arts, 1861. By the Society.

Journal of the Royal Geological Society of Dublin, vol. 9, part 1. By the Society.

Journal of the Royal Dublin Society, 1861. By the Society.

Journal of the Franklin Institute of Philadelphia, 1861. By the Society.

Mining Review, 1861. By the Proprietors.

Lean's Engine Reporter, 1861. By the Proprietor.

Magnetical and Meteorological Observations at Greenwich, 1859. From the Royal Society.

Quarterly Journal of the Chemical Society, 1861. By the Society.

Proceedings of the American Philosophical Society, January to June, 1860. By the Society.

List of Members and Laws of ditto. By the Society.

Obituary Notice of Dr. D. D. Owen. By Ditto.

Proceedings of the Institution of Mechanical Engineers of Birmingham, 1860-61. By the Society.

Proceedings of the Royal Institution of Great Britain, 1861. By the Society.

Report and Transactions of the Plymouth Institution and Devon and Cornwall Natural History Society, 1860-61. By the Society.

Report of the Royal Institution of Cornwall, 1860-61. By the Society.

Schriften der Koniglichen Physikalisch—Okonomischen Gesellschaft Zen Konigsberg. From the Society.

De Abietinearum Carr Floris Feminei Structura Morpholugica.

Transactions of the Royal Irish Academy, vol. 24, part 1. From the Society.

Transactions of the Royal Scottish Society of Arts, vol. 6, part 1. From the Society.

Annual Report of the Smithsonian Institution, Washington, U.S. From the Trustees.

Annual Report (1859) of the Superintendent of the Unites States Coast Survey. From the Smithsonian Institution.

Annual Report (1859) of the United States Patent Office—Mechanics, vols. 1 and 2. From the Smithsonian Institution.

Meteorological Observations made near Washington, Arkansas, from 1840 to 1859, by Nathan D. Smith, M.D. From the Smithsonian Institution.

Meteorological Observations made at Providence, Rhode Island, from 1811 to 1860, by Alexis Caswell. From the Smithsonian Institution.

Fluctuations of Level in the North American Lakes, by Charles Whittlesey. From the Smithsonian Institution.

Researches upon the Venom of the Rattlesnake, by S. Weir Mitchell, M.D. From the Smithsonian Institution.

Second Report of a Geological Reconnaisance in the south and middle counties of Arkansas, 1859-60. From the Smithsonian Institution.

Annals of the Lyceum of Natural History of New York, 1860. By the Society.

Proceedings of the Literary and Philosophical Society of Liverpool, 1860-61.

Domesday Book. From T. G. Baring, Esq., M.P.

ANNUAL GENERAL MEETING.

The Twenty-Ninth Annual General Meeting was held on Wednesday, January 29th, 1862. R. W. Fox, Esq., in the absence of the President, was called to the Chair.

The Secretary stated that Sir C. Lemon had written to beg to be excused, as he did not feel well enough to attend.

The Report of the Committee and the Treasurer's Report were then read, together with the lists of presents to the Society for the past year.

Resolved;—That the two Reports just read be adopted and printed.

The revised list of prizes and premiums was then submitted.

Resolved:—That the revised list of prizes and premiums be adopted for the ensuing year.

Resolved:—That the following gentlemen be elected Vice Presidents of the Society, in the place of those retiring by rotation:—C. Fox, Esq., R. Taylor, Esq., Rev. T. Phillpotts, Rev. W. Rogers.

Resolved:—That the Officers and Committees be re-elected, and that the following names be added to the Committee for the Falmouth and Penryn district—Miss A. M. and Miss C. Fox, and Mr. R. T. Hall.

Resolved:—That the Committee be authorized to forward a Memorial to the Prince of Wales, requesting His Royal Highness to become Patron of the Society in the place of his lamented Father, the late Prince Consort.

The following votes of thanks were then passed unanimously:—

To those Ladies and Gentlemen who kindly lent specimens of the Fine Arts, Curiosities, &c., for the last Exhibition, and who are severally named in the Report of the Committee.

To those Ladies and Gentlemen who so efficiently acted as judges at the last Exhibition.

To those Institutions who have kindly presented books and papers of their proceedings to the Society.

To Mr. J. Taylor, junr., and Mr. R. Taylor for their valuable present of the Portrait of their father.

Resolved:—That the thanks of the meeting be given to Mr. R. W. Fox for his very efficient conduct in the chair.

REPORT OF THE COMMITTEE.

1861.

In presenting their Twenty-ninth Annual Report of the progress of the Polytechnic Society, your committee feel that it is their first duty to pay a tribute of respect to the memory of two illustrious persons who during the past year have been removed from amongst us by the inevitable hand of death: they refer to the Vice Patroness of the Society, Her Royal Highness the Duchess of Kent, and to one who has for many years been a liberal supporter of this and the other institutions of the county, His Royal Highness the Prince Consort. The amiable qualities and many virtues of the Duchess of Kent have endeared her to the hearts of all, and apart from the loss that we feel we have ourselves sustained, we mourn as well for the grief that the death occasioned to our much loved Queen. A still more crushing blow, however, than the loss of a revered parent, has since fallen upon our Queen, the loss of a beloved husband,—a loss as sudden as it is irreparable—striking with a blow that seemed for a while to stun the whole nation, and startling even remote nations, wherever his name and virtues were known. As we too often find in our own individual circles, that the value of what we possess is never fully estimated until it is ours no longer,—so in this nation's loss, we find that heretofore we were in no wise prepared to feel how great such a loss would prove, but when awakened from our apathetic trance by the solemn hand of death, we begin for the first time to estimate the full value of the Prince who is no more; for whether we look to the calm domestic circle from which he was so suddenly snatched, whether we look to the domestic circles of those whom his liberality and wide spread generosity encouraged in the difficult path of life—whether we look to the kindred institutions to our own throughout the land—whether we look to the agriculturist at his plough, the manufacturer at his loom, the poet at his pen, the artist at his easel, the musician at his score,—wherever a virtue was to be inculcated, a social evil reformed, a nation's triumphs celebrated, or a great enterprise shaped and crowned,—he was ever forèmost to encourage and complete—a pattern and example to mankind, whether we regard him as a husband, father, friend, patron, or Prince.

In leaving this sad theme to revert to the position of the Society during the past year, and to its future prospects, your committee feel that it will be gratifying to refer you to the words of a valued friend and previous Secretary of this society, Professor Hunt. In a letter on the subject of a memorial to the Prince Consort, addressed by that gentlemen to the Secretary of the Society of Arts, and published in their journal, Mr. Hunt says: "In 1840 I became secretary of the Royal Cornwall Polytechnic Society, which still lives in vigour, doing its excellent work of rewarding annually every meritorious effort of human thought and human industry which may be submitted to its judges." Such testimony as this, coming from one so competent to form an opinion on this subject, must be regarded as a valuable evidence that the Society maintains its position in the general estimation, with no symptom of decline in its original vigour. It is certain, judging by the increased amount received at the doors during the last Exhibition, that a greater number of visitors were attracted to our hall than on any previous occasion, and we may reasonably hope that when our town is benefited by the increased facilities of traffic which will be afforded by the completion of the railway and progress of the docks, these annual gatherings may be still further augmented.

Perhaps the most important point to be noticed in connection with the last annual meeting, was the temporary amalgamation of our own society with that of the Miners' Association, which held its meeting within these walls. It has always been the wish of the promoters of the two societies that they should be made to work harmoniously together, and undoubtedly this first experiment of holding the meetings at the same time and place, must be regarded in a favourable light, giving as it did to the members of the Miners' Association an opportunity of inspecting the various objects collected in our Hall; and on the other hand bringing before the members of the Polytechnic a mass of interesting matter on subjects in, which they have always felt a peculiar interest, and in which but for this arrangement they might not perhaps have had an opportunity of participating. It has been thought by some old and esteemed members that this arrangement interferes somewhat with the usual order of proceedings in the hall, and perhaps coming as it did this year on the second day of the Exhibition, it may possibly have done so to some extent, but your committee consider that by a slight alteration in the arrangements, minor difficulties of this kind may be easily avoided in the future, should it be again considered desirable to hold the two meetings at the same time.

Another novelty in the proceedings of the week, which appeared to give general satisfaction, that of reading a portion of the Reports of Sections in the committee-room instead of from the platform, was this year introduced. A most interesting discussion was the result of this arrangement, for which we were indebted chiefly to Mr. R. Taylor, from whom the suggestion emanated, and who with his usual ability and varied knowledge imparted to the meeting some most interesting information on a variety of topics connected with the display of objects in the hall.

Your best thanks are also due to Mr. Taylor for the much valued portrait of his father, which in conjunction with his brother, Mr. John Taylor, he has this year presented to the Society. It is a copy executed by your secretary from a very valuable picture by Sir T. Lawrence, which was presented to Mr. Taylor, senr., by his friends some years ago. This portrait of one who, as Treasurer of the British Association, was for so long a period intimately connected with the advancement of science, and who has also been for upwards of fifty years prominently associated with the leading interests of our county, must be regarded by all as a most valuable addition to our walls.

Amongst the proceedings of the week, your committee feel that they are under great obligations to Professor Hunt and Mr. Brown for the interesting experiments in magnetic blasting which they were instrumental in bringing before the meeting. A detailed account of these experiments will be found in the usual place, together with descriptions of the most prominent objects of interest in the Exhibition.

The thanks of the Society are especially due to the Rev. F. H. Scrivener for the admirable and instructive lecture on "The Love of Learning," with which he favoured the members on the first evening of the Exhibition, and also to Mr. J. S. Phene for his lecture, with elaborate experimental illustrations, on the Physics of the Crust of the Earth;—while among those who have this year so kindly favoured the Society with valuable works of art to adorn our walls, must be mentioned Mr. F. M. Williams, who contributed no less than eighteen pictures; Mr. S. Gurney, to whom we were indebted for a most interesting collection of drawings, illustrative of the voyage of the steam yacht "Fox;" to the Rev. T. Phillpotts, for some fine ancient and modern pictures, especially one of great beauty by Hermann; to Mr. T. R. Crampton, C.E., for three exquisite specimens of McKewan; and to Mr. E. B. Tweedy, Mr. A. L. Fox, Mr. N. Fox, Mr. Allen, and others, for several interesting works of art; and to the owners of the magnificent picture which occupied the end of the hall—"The Relief of Lucknow;" your especial thanks are due for sending it from Plymouth at the mere cost of the attendant expenses. For contributions of interesting curiosities, you have to acknowledge the kindness of Capt. Broad, R.N., Mr. W. Carne, Mrs. Valler, Mr. Tregidga, and other ladies and gentlemen of the neighbourhood.

The contributions for competition in the various departments were as numerous as on previous occasions, but the committee consider it unnecessary to refer to any individually in this general report, as all those of any importance will be mentioned in the subsequent notices of the various departments. As a proof, however, that the labours of the committee and judges continue to be productive of fruitful results in that especial department of the exhibition connected with mechanics and mining, they refer with pleasure to a letter received from Mr. Borlase, who in 1860, it will be remembered, exhibited a machine for dressing ores, which excited considerable controversy, but obtained an award of the Society's first bronze medal. Mr. Borlase writes, "As the time draws near for another of your exhibitions at the Polytechnic Hall, I cannot forget the one that is past, and the kindness I received when I was there with my model. Believing you will be glad to hear what progress I have made, I take the liberty of giving you a short illustration of my proceedings during the last twelve months." He then goes on to state that he had erected his machine at Wheal Margaret Mine, which proved satisfactory, and another on a large scale, 20 ft. diameter, at Providence Mine, Lelant, which also proved satisfactory. Capt. Hollow, of Providence Mine, then built an ordinary round buddle to test against it, and the results were so much in favour of Mr. Borlase's machine, that Mr. Higgs, the purser, bought the patent right for Wheal Providence, to erect as many as they thought proper. He adds also that the one at Wheal Margaret is nothing inferior, and that the agent's report at the last meeting stated that it surpassed the old process by 50 per cent.

It is with unfeigned regret that your committee have to state that in addition to the loss of the two illustrious persons to whom reference is made in the beginning of this report, the yearly obituary contains the names of an unusual number of old supporters of the Society: the Earl of Mount Edgcumbe, Lieut.-Col. H. Smith, Miss Dyke, Mr. D. Barclay, Admiral Sir Barrington Reynolds, Mr. J. Hustler, Mr Branwell, Mr. S. Blight, Mr. T. Symonds, Mr. N. Harvey, and Mr. Tregelles, have all been taken from amongst us, some under circumstances of painful suddenness, some while yet in middle age, some after a long and honourable career of usefulness, full of years and fame.

With regard to the financial condition of the Society, your committee have first to report that the appeal to the members for assistance towards the payment of the loan on the hall has resulted in subscriptions for that purpose, to the amount of £74 5s. 6d., which is, however, but a small proportion of the sum required. The sub-committee appointed for this purpose will, with the approval of the members, shortly take into consideration the best method of raising a further sum towards this object. In addition to the sums subscribed for this especial purpose, your committee recommend the payment of £15 from the receipts of the year towards the further reduction of the loan, as they have this year saved this amount by the death of Mrs. Hopkins, to whom an annuity has been paid for several years past. They have been reminded that there was an old understanding to the effect that when this annuity fell in, it should be devoted to the reduction of the loan, and with the consent of the members the committee are prepared to make this arrangement. The loan, which was originally £300, will this year, therefore, be reduced to very little more than £200. With regard to the other expenses, although from the great increase in the number of objects sent to the exhibition the disbursements have been unusually heavy, the increased amount taken at the doors has enabled your committee, after paying the current expenses and transferring the £15, to carry forward a balance to next year of £6 6s. 11d.

THE ANNUAL EXHIBITION.

The Twenty-ninth Exhibition commenced at the Polytechnic Hall on Tuesday, Sept. 17th, and was not less successful than the best of its predecessors. The body of the spacious Hall was well filled with mechanical inventions and models, collections of natural history, fancy work, curiosities, &c.; and the walls of the surrounding gallery were covered with paintings and drawings presenting a generally higher standard of excellence that at any former exhibition. The most prominent object of the Exhibition, in the gallery opposite the chair, was the noble picture of the Relief of Lucknow, of which the most prominent group is Lord Clyde grasping the hand of Havelock, who, with Outram, is meeting him. The large table under the platform was filled, as usual, with the smaller mechanical productions; on the floor in front of it were the larger machines and models. In the centre of the hall was a large fountain, to which was attached a bottle washing machine, which afforded much amusement to the juvenile portion of the visitors; beyond this, a polished granite vase on a high pedestal, contributed by Messrs. W. and J. Freeman, and nearer the door, the well-known bust of H.R.H. the Duke of Cornwall when a child, by our Cornish sculptor, Burnard, on its beautiful pedestal of polished porphyry. On the right of the Hall from the door were collections of natural history, and a railed enclosure, within which were two beautiful mosaic tables of serpentine, by Mr. Pearce, of Truro, specimens of grained wood in imitation of polished stone, by Mr. Saunders of Plymouth, choice glass and porcelain from Messrs. Apsley Pellatt and Co., and Parian statuettes, a splendid enamelled tray, magolica ware, and encaustic tiles, from Messrs. Minton and Co.; on the other side were models of naval architecture, fancy work, and a glass case where Mr. Slade Olver exhibited a choice display of electrotype plate and cutlery.

There were also two Marine Aquaria, curiosities from China, a splendid cockatoo cage from Japan, sewing machines at work, and a well executed trophy of ocean telegraphs. In the centre of the latter was a representation of the "Agamemnon" and "Niagara" laying the Atlantic cable; a pillar on either side, surmounted, the one with English, the other with American emblems, was formed of different sized pieces of ocean telegraph cables, polished, and ornamented; and around were suspended specimens of some of the principal ocean lines.

Among the inventions from this county, Mr. Sara exhibited a double action ship's pump, calculated to discharge a continuous stream of water from two openings, and which may be converted into a fire engine in the event of the ship taking fire. It is a simple and ingenious machine, and appeared to be favourably regarded. Mr. Terrill, of Redruth, exhibited a model of a rifle camp stove, on a scale of four inches to a foot. It is most compact and complete, and by a judicious arrangement of the flue, it heats, with a single fire, six ovens, a boiler for water, two large cooking boilers, and four smaller boilers and steamers. He also exhibited an improved kitchen apparatus, in which the hot plate is wider than usual, and the opening at the top so modified as to boil a kettle much faster when the damper is out. On the table was a beautifully finished horizontal steam engine of working size, made by Thomas Hosking, an apprentice at Hayle Foundry; and made, we understand, at his home with no assistance from the works, except for boring the cylinder. It would not have shrunk from comparison with the workmanship of the beautiful engines which were lately exhibited at Truro; from which it may be inferred that if Cornish apprentice boys can make such engines, Cornish engineers will be found equal to anything which may be required of them.

The models of Naval Architecture were as numerous, and of perhaps a more highly finished character than usual. Among them were a model of an iron vessel to carry

800 tons, now building at the yard of Messrs. Sandys Vivian, & Co., Hayle; and a model in frame of a vessel of similar tonnage by Mr. Paynter, of St. Ives; a very large model of a 23-gun corvette, finished with the greatest regard to accuracy and completeness; models to a scale of a 50-gun steam-frigate by Mr. R. Hancock; a steamer on her cradle for launching; a steam yacht; a 110-gun screw line-of-battle ship; a schooner yacht; a row galley under lateen sails; several boats; and a well-executed group of a barque under full sail, with a pilot cutter attending her; and a French lugger—the whole carved in wood.

The collection in Natural History was good, and on the whole extensive. There was a case of choice minerals; several cases, well set up, of British butterflies and moths; a general collection of insects, &c., from the neighbourhood of Falmouth; a case of some of the rarer insects, with some specimens of lizards and scorpions, not, however, arranged in scientific order. Another case of curious or rare specimens, chiefly marine, and very well preserved; among them some of the anneloids, showing their branchiæ. In this case was also a very good specimen of that curious lizard the Flying Dragon. A collection of British shells, in three cases, reflected very great credit on the industry and intelligence of the collector; the specimens were very complete, well selected, and well arranged and displayed. There were several cases of stuffed birds, all of them excellent and well set up. The most interesting individual specimens were a splendid and rare Pheasant from Himalaya (*Tragopan Hastingsii*) and the Lyre bird; a very large case of Australian birds, with falcons, owls, golden and other pheasants, herons and egrets, bitterns, scarlet ibis, woodpeckers, divers and other sea birds, different species of ducks, and a case representing a winter scene, the ground under snow, with woodcock, snipe, robin, and pied and common blackbirds.

In the Fancy Work department were specimens of embroidery, knitting, patchwork, artificial flowers, some good specimens of wool work; among the latter, a spirited copy from Boydell's Shakespeare of the entry of Richard II. and Bolingbroke into

London, and another of the Goldsmith's daughter; two specimens of embroidery were the work of a person 81 years of age. In this department was exhibited a large and beautifully ornamented ivory cabinet, a choice and useful ornament for a lady's boudoir.

THE FINE ART EXHIBITION.

The Fine Art Department forms perhaps to the great majority of visitors, the most attractive portion of the exhibition, and this year it was more than usually interesting, the collections of pictures being quite equal in extent and more than equal in point of merit to that exhibited in any previous year. On former occasions, the pictures of ancient and modern artists sent for exhibition have scarcely been sufficient to cover the space assigned to them—the end and right hand side of the hall—and the directors of the exhibition have had to make up the deficiency in the best manner they could; but on this occasion no such difficulty was experienced, and throughout the whole of the extensive collection, comprising the works of a very large number of artists, there was scarcely one inferior picture. The contributions of works of old and modern artists by private gentlemen were numerous, Mr. F. M. Williams, of Goonvrea, having sent pictures by Barnes, Luker, Horlor, Wainwright, Albert Krafft, Shayer, Herring, Hobbima, Onwater, Armfield, and Verheyen. There were two fine pictures among the contributions of Mr. Williams, by Herring, his well known engraved picture of "The Farm Yard," and his "Harvest Field," both of great excellence. One of the most striking and admirable pictures in the entire collection, is one by Mr. Sydney Cooper, A.R.A., "Cattle on the Hills," which is valued at £300. "Milking Time," by Shayer; "Dogs after Hedgehog," by Mears; "Outward Bound," by Callow; "The Rialto, Venice," by Pritchett; and "Clovelly, North Devon, Lundy in the distance," by Horlor, were pictures of considerable merit, exhibited by Mr. Radclyffe, of London. Mr. S. Gurney, M.P., contributed a number of valuable pictures and water coloured drawings, including a very splendid painting "The Dream of the Future," the joint production of W. P. Frith, R.A., T. Creswick, R.A, and J. R. Ansdell, A.R.A., and which both in conception and execution, exhibited great poetic power of treatment and vigorous masterly handling. This was undoubtedly one of the sweetest and most exquisite pictures in the collection; the face of the girl, who appears to be lost in a reverie, is beautifully painted, as indeed is the entire picture. Mr. Gurney also contributed a very striking picture by Beechy, of the "Fox" steam yacht, while employed on the East Coast of Greenland, in surveying the route of the North Atlantic Telegraph; a very fine picture by Wolf, "The Black Swans;" and "The Rival Fountains;" a water coloured drawing by George Cruikshank, which forcibly illustrated the strikingly divergent results attendant upon the patronage of "The Gin Fountains," and "The Water Fountains;" likewise a series of sketches of the perilous positions in which her Majesty's ship "Investigator," was placed in the Arctic Regions, during her celebrated voyage in search of Sir John Franklin, drawn by Lieut. Gurney Creswell. Mr. T. P. Smyth, of Plymouth, exhibited an excellent picture by Teniers, "The Guard Room;" and Mr. F. Robjohns sent two choice pictures, "View on the Tavy," and an "Italian Organ Boy." Mr. E. B. Tweedy contributed two very excellent pictures, "The Tired Soldier," by T. Lawrance, and a view up the Lleden, by N. W. Bromley. Mr. T. R. Crampton, C.E., exhibited three of the most splendid water colour paintings in the exhibition, "Views on the Smyrna Railway, now in course of construction," by M'Kewan. There were also valuable paintings by Hermann, "View near Rotterdam," "The Three Ages;" by A. Carracci, after Titian; "Joseph Interpreting the Dreams of the Butler and Baker," by Carravagio; four views near Rome, by Orizonti, kindly contributed by the Rev. T. Phillpotts.

The pictures by professional artists were also very numerous, and generally of great excellence; amongst them were contributions by several artists who until recently exhibited as amateurs. This is gratifying, as affording evidence of advancement among art students in the county. Mr. Sydney Hodges, the Secretary of the Society, contributed some dozen or fourteen pictures, amongst which were a very striking portrait of Miss Crampton, and two very pretty pictures, "Colleen Bawn," and "Colleen Ruadh," suggested by Boucicault's new drama. Mr. Philp contributed a number of very chaste and admirable water colour paintings; and Mr. Hart, of Falmouth, exhibited ten choice pictures of the same description. Mr. W. Williams, of Topsham, was a large exhibitor, there being no less than twelve of his pictures. One of them (a view on the Tavy) was a very striking production. There was also a picture by Mr. J. Gendall, of Exeter. Mr. John Squire, of Camborne, was an exhibitor in this class. Having won the highest distinction which the society could confer last year, he this year—the third occasion on which he has exhibited at the Polytechnic meetings—took his place among professional artists, and proves himself no unworthy competitor. He sent four water-colour paintings, all of great excellence and beauty. They were—a view of "Gwithian Sands the morning after a gale;" "view of the coast near Tehidy;" "Lower Newham, Truro River;" and the "Miners' Bridge, North Wales." Mr. C. E. Brittan, of Plymouth, formerly of Truro, exhibited two very pretty pictures—"Views of Clovelly, North Devon," and "Early Morning on the coast of Tol Pedn, Penwith, near the Rundle Stone, after a gale." They are both very favourable specimens of this young artist's works. Mr. J. J. Offord, of Plymouth, had four meritorious pictures.

The contributions by amateurs were larger in number than in previous years, and of about average merit. The pupils of the Penzance School of Art exhibited a number of very meritorious drawings, and those of the Truro School were exhibitors of several equally creditable. Amongst the other exhibitors in this class were Mr. R. H. Carter, of Truro, who has three creditable water-colour views; and Mr. T. H. Mitchell, who exhibited a large number of drawings, principally illustrative of sacred subjects. Amongst the exhibitors of the other sex was Miss M. L. Jenkins, of Truro, who contributed an admirable drawing of an antique column from the Vatican. Mrs. Sydney Hodges exhibited a very finely arranged stand of choice wax flowers.

The School Productions were extensive, and comprised contributions from Falmouth, Bodmin, Redruth, Penryn, St. Ives, Truro Central, British, and St. John's Infant, Falmouth British, Gwennap National, Kimberley Falmouth, Mylor Bridge, and other schools.

The hall proving insufficient for the display of the whole of the Fine Art Collection, a number of architectural drawings, amateur productions, and very fine photographs were exhibited in the committee-room adjoining.

THE ANNUAL MEETING.

Shortly after half-past one o'clock Sir Charles Lemon, Bart., the president of the society, came upon the platform, followed by Mr. R. Taylor, Professor Robert Hunt, Mr. Bennetts, the Rev. S. Rogers, Rev. T. Phillpotts, Rev. G. Edgcumbe, and other gentlemen.

Sir CHARLES LEMON took the chair and opened the business of the meeting by saying that he merely did so as a matter of form, but Mr. R. Taylor had kindly consented to act for him, and that gentleman would probably have something to say to them on the subject of the exhibition.

Mr. R. TAYLOR said that before taking the chair, at the request of Sir Charles Lemon, he had another duty to perform, which was to ask the society to accept from his brother and himself a copy of the portrait of his father that was painted 35 years ago by Sir Thomas Lawrence. The portrait was considered an excellent likeness of his father, and admirably painted; it had been faithfully copied by Mr. Sydney Hodges, and he had now to ask their acceptance, on behalf of the society, of the copy so made. (Applause.)

Sir Charles Lemon then left the chair, which was taken by

Mr. TAYLOR, who said, I can assure you ladies and gentlemen, that I feel very great reluctance in undertaking the duty of addressing you to-day. I had hoped up to the last moment that Mr. Rogers would have discharged the duty as he did last year, but unfortunately he is unable to attend, and I must say that you have in me a very unworthy substitute for that gentleman, as I feel he would have acquitted himself in a manner that I cannot hope to approach. Before referring to some of the objects of interest in the exhibition, I will take the liberty of explaining a change in the order of our proceedings which has been adopted.

Some months ago, at a general meeting of the society which was then held, a suggestion was made that instead of having the whole of the reports of the judges read in this room, a certain portion of them should be withheld, and read at the conclusion of the meeting in the committee-room. The former plan of reading all the reports in this room was considered to be inconvenient and unattended with any advantage, because reports on serious matters of science and mechanical invention cannot be attended to in the buzz of conversation which takes place on the beautiful and interesting objects by which you are surrounded on all sides, and it was proposed that we should reserve the reports on the sections of mechanical inventions, natural history, and naval architecture, to be read in another room. This suggestion was approved of, and it was determined that the reports on the fine art department, the amateur, the school productions, and the plain and fancy work shall be read now, and that we shall read those before named at the conclusion in the committee-room; and we shall then invite discussion on these subjects. I believe that at almost all similar exhibitions of the society, the gentleman who has presided at these meetings has found himself in a position to congratulate you on its continued success; and I am gratified also in being able on this the first occasion of my taking this chair, to state to you that the Polytechnic Society appears to progress prosperously. The present meeting is numerously attended, the weather is as favourable as we can desire, and I think I may confidently say that the collection in the fine art department is very large and very valuable. I am certain that the collections in the departments of physical science and mechanics are extensive and highly interesting, because with these departments I am more familiar, and I have gone through them carefully. In these departments we are much indebted to the exhibitors who have sent their machinery and inventions, many of them from a considerable distance to this county. Only yesterday I heard a gentleman remark that it was of the utmost importance that those who were engaged in mining and other mechanical pursuits should have brought before them those excellent inventions and appliances which have been approved and adopted in other parts of the kingdom, in order that they may examine them, and where useful, adopt them. One of these inventions is Bailey's steam gauge, which is on a different principle to the steam gauges in use; and it is likely to prove a very useful article. One of them is now at work at the steam engine of the saw mills, at the Falmouth Docks. The committee have awarded to the one exhibited a premium. Behind the steam gauge is a mortising and tenoning machine, with self-feeding motion, which performs these operations most effectually. Then we have what appears a simple invention, but which is likely to prove a very useful one—namely, the improved spiral fluted nails. They are the invention, not of a Cornishman, but of a person at Exeter. The judges consider that these nails will prove a great advantage in many kinds of work—that for strong work especially they will be found very useful, and the maker, who was here yesterday, guaranteed that they should not cost more than common nails. You will observe that the heads are cut across like screws, but that is not for the purpose of driving them into the wood, as they are hammered in like the common nail, but for the purpose of enabling them to be easily taken out again when necessary. Then we have a very curious application of bitumen t› the manufacture of pipes. You have specimens of these pipes on the table, and they are made of such apparently flimsy materials as paper and bitumen, but which when so made, are capable of bearing a pressure of from 200 to 220 lbs. to the square inch. In this county the water in mines is impregnated with acid, which destroys the iron pipes employed, and I think Mr. Hunt will bear me out that these pipes are likely to resist the action of such acid. (Mr. Hunt—No doubt.) That being so, I think they might be used with great advantage in this county instead of iron pipes, especially as they will not cost half so much as the latter. There is also a very ingenious invention called the differential pulley block, which hangs on the left hand side of the hall, and which has been contributed by a distant exhibitor. By means of that simple machine you can accomplish what is usually effected with the aid of blocks and winch. With a force of one lb., you can lift 20 or 22 lbs., and this morning, an illustration of its capability was afforded by a lady, who, with one hand, hoisted up her husband, who is not a very light weight. (A laugh.) I must not omit to call your attention to the sewing machines which are exhibited. You will recollect that at the exhibition last year, a great deal of interest was excited in the exhibition by the number of these machines which were exhibited. This year we have only one or two of these machines, but I believe that these, in the opinion of the judges, are very superior. The same exhibitors have sent us a very useful article which is just below me. It is an umbrella stand, and is a very simple looking article, but it is a useful and ingenious inventiou. It will secure the umbrellas placed in it against all attempts of thieves to steal them, for when an umbrella is placed in any of the compartments a key is shot out and you can lock the umbrella up, and no one can remove it without that key. Then with regard to new inventions, if those brought out in our own county are not so numerous as on some former occasions, still there are some that are likely to prove of considerable value. There is, for instance, the double action pump, which can be used either on shipboard or as a fire-engine on shore. It is capable of being applied as a force pump, drawing the water to feed it at the same time. It is the invention of Mr. Sara, of Penryn. Then we have a valuable machine for washing lead ores, exhibited by Mr. Hunt, of Porthleven. There can be no doubt that it will prove of great benefit to lead mines, and had the judges been satisfied that it was entitled to be considered a new invention, they would probably have awarded it a high premium; it is, an improvement of the principle adopted in what is called a "jigging machine"—being a jigging machine worked by a forcing pump, and is evidently founded upon one employed on Fowey Consols Mine, by Captain Petherick, but at the same time it is a great improvement. The application of these machines to the washing of coal dust, has become very extensive in France and the North of England, and you can hardly form a conception of its value for this purpose. In France and the North of England, immense heaps of coal dust accumulated at the coal pits, which encumbered the ground, and were not only valueless, but frequently a source of inconvenience. Now, this machine cleans the coal dust from the earthy and other worthless particles with which it is mixed, at a small expense, and the dust so cleaned is found to make the very best of coke; so that by the application of the machine, a previously worthless material has become of great value. Mr. Hunt has applied this principle to the washing of lead ores, and I believe that every one who has seen this machine at work will allow that it is most effective. There is another thing in this department of the exhibition which is deserving of your attention. It is not an invention, but a series of observations on spots on the sun, continued throughout a year, by a young lady only fifteen years of age. Her report which is clearly and correctly written, describes the observations as having been made daily, while walking to and from school, and she sends with her report a number of diagrams showing the spots at different periods. The judges have awarded this young lady a premium, but this premium is not such as they would have felt called upon to accord to her, had they been assured that her observations were accurate. They doubted whether her observations could be accurate with the imperfect apparatus at her command, and they have reserved to themselves the right of increasing the premium, should it hereafter prove that they are mistaken. They have determined upon sending the observations to the Observatory at Kew, in order to ascertain whether they are correct, and if so, they will probably bestow a higher premium. We have also in this department, machines and models which do not display any novelty of invention, but which are remarkable for the great excellence displayed in their construction. Among them is a very beautiful model of a horizontal steam engine, the work of a young man an apprentice at Hayle Foundry. Then there is the traversing plan showing the whole of the workings of the United and Wheal Clifford Mines, with the traversing protractor, combining parallel ruler and scale, an instrument designed by Capt.

Gray, of the United Mines. Gentlemen connected with this sort of work will there see that Capt. Gray has produced a very convenient and useful instrument. I am afraid that I am wearying you by entering at such great length into these details, and I should now have closed my remarks, but our secretary reminds me that there are one or two articles to which I ought to refer. There is on the table to the right what is called an "Incomparable Bed." Certainly it is a very comfortable bed, for we tried it yesterday. It was brought to us wrapped up in a small bag, but with the aid of a small pair of bellows it was soon inflated and assumed the dimensions which you see. The same exhibitor sends several life belts and jackets for saving life in case of shipwrecks. Then we have from an exhibitor in our own district, Mr. Terrill, of Redruth, several cooking apparatuses which are said to be excellent, especially one suitable for camp service, and which is said to be free from those objections which are urged against those employed in our army. I ought also to mention an instrument sent to us by a gentleman who was formerly secretary of the Polytechnic Society—Mr. Jordan. He is known as the inventor of ingenious machines for wood carving, and he has now sent us a miner's dial, which he states combines everything that can be required by the miner in that respect. The dial is well protected, appears to be a valuable instrument, and is very cheap, and the judges have awarded to it one of their medals. The next thing which I must allude to, is the piano which you see on the platform. The peculiarity in this instrument consists of the application of certain metallic tubes at the back of the sounding board, which have the effect of prolonging in an extraordinary degree the sound of any note that may be required. There are also other improvements, on which I will not, however, venture to dilate. I now turn from that department in which I have been one of the judges, and on which I was requested to speak more at length than I should otherwise have ventured to do, to address myself briefly to the fine art exhibition. I am told by the gentlemen who have acted as judges in this department, that the collection of works of art has given them great satisfaction, and doubtless they will state so much in their report. It is gratifying to find that the exhibitions of the society continue to be so liberally supported by gentlemen connected with the county, who send us their valuable pictures; and on the present occasion we have valuable works of art lent us by the Rev. T. Phillpotts, Mr. F. M. Williams, Mr. S. Gurney and others. I need not attempt to point out the merits of the collection, or its principal features of interest, because this will be referred to in the report of the judges; but I may state that I have been told the picture by Teniers is one of great value, a fact that cannot fail to strike every one who examines it. The cattle piece, by Mr. Sydney Cooper, is also a work of great beauty and excellence. On the other side of the room we have also many beautiful and interesting pictures contributed by gentlemen in the manner I have stated. Amongst them our thanks are in particular due to Mr. Crampton, for having sent three magnificent views of scenes on the line of railway which he is engaged in constructing near Smyrna. Mr. Gurney has also sent us a series of interesting views, by a gentleman, a relative, I believe, Mr. Gurney Cresswell, forcibly displaying the dangers and disasters of her Majesty's ship "Investigator," during her search for Sir John Franklin in the Arctic Regions. I should also state that we have the usual number of contributions from the Penzance and Truro Schools of Art, and I may mention that among the pictures sent for competition by local artists are several of great beauty and excellence. I will not, however, venture to dilate upon them; but there is one fact which I will mention, as it is one of no small interest, and that is that two gentlemen who commenced by exhibiting their productions among the amateurs, have made such progress, that their pictures now take their places among those of professional artists,—I allude to the pictures of Mr. Squire and Mr. Brittan. With regard to the manufactured articles, I have very little to say; I shall merely state that the beautiful vase of polished granite which you see before you has been sent by Messrs. Freeman, of Penryn. You all knew that last year these gentlemen exhibited a number of objects of great interest and beauty, and though they have not sent so many on this occasion, yet they have shown that they feel a strong interest in these exhibitions. I consider that we ought to be proud at knowing that their manufacture of granite has become so celebrated that polished blocks of it have been ordered from them to be sent to Italy to form the base of the column erected to the memory of the late King Charles Albert; as well as for the mausoleum of the late Duchess of Kent. Mr. Taylor then concluded by referring to a portrait of his father, recently painted from life, by the secretary, Mr. Sydney Hodges, and complimented the artist on the great accuracy of the likeness, as well as for the faithfulness of the copy, which he had also executed from the picture by Sir T. Lawrence.

Mr. C. Fox then proposed a vote of thanks to Mr. Taylor for the very gratifying gift which he had just made the society, of the portrait of his venerated father—a man whom he highly eulogized for the benefits—scientific and practical—which he had conferred, not only on this country, but every other in Europe; and he was sure they would be all gratified to learn that the lapse of 30 years had added but little to the ravages which time had made on his venerable face.

The resolution was carried by acclamation.

FINE ARTS.

The Rev. T. Phillpotts read the following report on the Fine Arts' Department:—

The Judges of the Fine Arts have pleasure in reporting that they have viewed with satisfaction the department of the present exhibition to which their attention has been directed. Professional artists have contributed works of great merit, but the judges must express their regret that there is so little competition among the amateurs. Although their works are not numerous, there are, however, some which evince steady and unmistakable improvement. Amongt the most deserving are a medallion by Mr. Petherick, and a drawing from nature by Mr.

Strongman. The judges are glad to find that the utility of these associations in fostering amateur talent, is shown by the fact that Mr. Squire and Mr. Brittan have recently become avowed members of a profession in which it may be confidently expected they are destined to obtain increased honour. The judges have had great pleasure in awarding prizes to pupils in several Schools of art, and of acknowledging a degree of proficiency highly creditable to themselves and their teachers. They hope that these public marks of approval will tend to call forth increased application—to encourage the production of original designs, and that on future occasions their contributions will not be confined to works which have been already exhibited and rewarded elsewhere. The judges feel that they cannot too strongly recommend schools of this description—they ought, in their judgment, to be established in every part of the county—supplying as they do the opportunity of obtaining first-rate instruction at an almost nominal expense. The growing influence of societies like the present, is abundantly manifested by various beautiful productions in other branches of the fine arts, many of them furnished by individuals wholly unconnected with this county, who have been induced by a knowledge of our efforts to add in an important degree to the attractions of the present exhibition. Among these may be especially noticed, a collection of photographs by Mr. Robinson, of Leamington, possessing peculiar, and, as the judges believe, novel claims to public approbation. Specimens of engraved glass by Messrs. Apsley Pellatt, and Co., and of Majolica and Parian, of beautiful design and finished execution, by Messrs. Minton, call for the highest commendation. A series of architectural drawings by Mr. Appleton, of Torquay, will be found of great merit. They are the first which have been sent to the society, and it is hoped, are the precursors of other designs in the same branch of art. The cordial thanks of the society are eminently due to those gentlemen who have liberally lent many highly valuable paintings, with the laudable intention of not only increasing the attractions of the exhibition, but of stimulating that appreciation and love of excellence in art, which it is the chief object of the society to promote. It is to be regretted that several former exhibitors do not appear as contributors on this occasion, attributable, doubtless, in a great measure, to the rule which precludes from competition those who have already received the society's highest prize. The judges are of opinion that, however advisable in early stages of their proceedings the rule may have been, the time has now arrived when some relaxation of it may, with propriety, be adopted, and they strongly recommend that this suggestion may receive the immediate attention of the society. On concluding their duties, the judges cannot refrain from expressing their unqualified gratification at the many striking proofs of progress so conspicuously presented on this occasion. It may be expected that the facilities of rapid intercourse between Falmouth and other parts of the county, which are shortly to be supplied, will operate favourably in respect of this and the other more general interests of the vicinity, and upon the whole they thankfully record their conviction that in the future prospects of the society, there is much to encourage hope and to justify perseverance.

SCHOOL PRODUCTIONS.

The Rev. S. Rogers read the report of the Judges of School Productions, as follows:—

Drawing, &c.—The Judges in this Department are glad to report an improvement in the productions of schools for the working classes. Two outlines hanging in the committee-room (328 and 327), are truly and carefully drawn, and the books of outlines, both from schools and individuals, show advance from last year. In class 3, a prize of £1 is awarded to a crayon head of Niobe, drawn from a bust, in which the rounding is well rendered. The drawings of locomotives from the objects themselves, are very creditable in point of outline. The judges hope that in future years a larger number of water-colour drawings and sketches will be exhibited. They would also suggest, for exhibitors of classes 3 and 4, the study of outlines of flowers and leaves from nature. They are glad to trace the increasing influence of the government schools of design in raising the standard of drawings exhibited.

The Rev. G. EDGCUMBE read the report of the Judges of School Productions in Penmanship and Maps.

Maps, Penmanship, Mechanical Drawings, &c.—The Judges have to report their satisfaction as to the general neatness of the contributions to this department, and the majority of the specimens exhibit great care and industry. As an example, they would refer to copybook No. 352 (by R. Corfield, Trevarth school.) The judges would take this opportunity of recommending to schoolmasters "Darnell's Guide to good Handwriting," as tending to promote a bold and free style of penmanship. The maps require no special comment. The judges have awarded two prizes to mechanical drawings, hoping to stimulate a greater competition in this department in future. The judges regret that there were not more competitors for the Lander prizes.

PLAIN AND FANCY WORK.

Mr. SYDNEY HODGES read the report of the Judges as follows:—

Mrs. Blight, Miss Rogers, Miss Vigurs, Mrs. Reynolds, Miss Phillpotts, and Miss Molesworth, wish to observe that they have not awarded any prizes to Berlin wool work, seeing nothing original in what has been sent in, but are much pleased with the quantity of plain needlework, and the quality of that work, which they consider much more worthy of encouragement.

After the reading of these reports, the Chairman and many of the company proceeded to the library to read the reports on natural history, naval architecture, and mechanical inventions, upon which it was deemed desirable that discussion should take place.

The Judges in the Natural History Department had not drawn up any formal report, but the Rev. W. Rogers explained their reasons for the prizes they had awarded, and for withholding them from some objects generally meritorious. These were cases, chiefly of insects, but they contained other specimens unconnected with their general object, and they were neither classed, nor named. To these the judges had not thought fit to grant a prize.

NAVAL ARCHITECTURE.

Capt. Wake, R.N., read the following report of the Judges on Naval Architecture:—

In Naval Architecture, but few novelties are exhibited. Capt. Baker's corvette, which obtained a silver medal some years ago, is the best and most correct specimen exhibited. No. 551.—A beautifully executed drawing of the engines of her Majesty's frigate "Constance," is awarded a prize of £1. 552.—The model of a vessel in frame, designed by a shipwright in Cornwall, (W. Paynter) is awarded a prize of £1, for workmanship displaying skill and perseverance. It would have been more prized if there had been less hollow in the run. 553.—Case with barque and pilot boat, (W. Gill) £1. 555.—Model of a schooner, by J. Christophers, Falmouth, is awarded £1 for skill and neatness of workmanship. 556.—Model of a steam yacht—a beautiful piece of workmanship, by R. Flower, Devonport, awarded £1. 557.—Model of a steam frigate, by Mr. R. Hancock, showing the disposition of frame and plank, with plan of decks and fitments, as fitted to H.M. ships, on a scale of one-eighth of an inch to a foot, by an amateur, has had a prize awarded. 563, 564, 565, 566.—Saxby's Sphereograph, and Mariners' Ready Reckoner, which professes to do difficult problems in Navigation without calculation, is referred to a select committee.* 567.—A block model of an iron vessel building by Messrs. Sandys, Vivian, and Co., Hayle, is awarded thirty shillings, being considered a better model than No. 557; though the run is somewhat too full, that fault may be turned to account as giving room for stowage.

REPORT OF THE JUDGES OF THE MECHANICAL DEPARTMENT.

The Chairman, Mr. Taylor, then read the report on Mechanical Inventions, which was merely a recapitulation of the objects exhibited and prizes awarded, and has already been embodied in Mr. Taylor's remarks.

* Medal since awarded.

The reports having been read, Mr. Charles Fox observed, with reference to the collections in entomology, that the most valuable contributions on this subject would be monograms of distinct classes. It was stated in illustration of the extent of such distinct collections that the late Mr. Dillwyn, some years since drew up a descriptive catalogue of beetles, which he had found in only one locality, the neighbourhood of Swansea, and that it contained upwards of 1000 species.

The Rev. Saltren Rogers stated that the Horticultural Society in his own parish of Gwennap, with the view to promote the study of botany among the working classes, had offered prizes for collections of British plants. It was remarked that the Horticultural Society of Cornwall, had, in its early days, awarded prizes for rare Cornish plants. The Rev. T. Phillpotts stated that the late Professor Henslow, had successfully got up collections of indigenous plants in his own parish.

A conversation then took place, chiefly by the Chairman and Capt. Wake, on the present conflict between armour for ships and artillery. Capt. Wake related a recent trial between an Armstrong and an old iron gun, in a sea-way, in which the aim of the old gun proved more accurate than the Armstrong in two trials, the captains of the guns, one of whom was the gunner of the Cambridge, and therefore, a practised artillerist, having changed guns in the second trial. The superiority of the improved modern guns therefore, cannot yet be deemed so decidedly established at sea, where the gun is fired from a rolling platform at a moving object, as we have generally thought. Mr. Taylor had recently seen La Gloire, and other ships now building, to be protected with iron plates, and he believed the present state of the question was, that the plates could be pierced with heavy bolts, but that the missile would, in such case, only make a hole and do comparatively little mischief. But that the effect of very heavy shot fired at a comparatively low velocity, would, by the concussion, destroy the attachment of the plates to the wood, and leave the vessel unprotected. Jones's plate had appeared to be a success on the first trial, but on a second, enormous shot fired at a low velocity, knocked the target to pieces. Mr. Morcom enquired as to the protective efficacy of Bessemer's steel? Mr. Taylor replied that the quality of steel was too unequal to be relied on, and that at present nothing was found equal to good rolled iron.

A conversation followed on subjects in the Mechanical Department, chiefly on those upon which, for want of satisfactory proof of their power to fulfil the promise of the exhibitors, the judges had postponed their decision, or referred them for trial. It was desired to discuss the subject of spots on the sun, a paper on which, by a youthful observer, has been referred to the Kew observatory that its accuracy may be proved, but in the absence of Mr. Hunt, who had left the Hall, the subject was postponed.

An interesting discussion followed on Victor's metallic safety fuse, upon which experiments were to be made at the Docks next day; when Professor Abel's system of magnetic blasting would also be explained. Mr. Taylor explained the manufacture of the present fuse, by charging hemp with fine powder; stating that from the presence of a chip in the coil, or from some other cause, the fuse might miss, and the hole not go off. In such cases, it is the rule to wait a sufficient time for safety, before picking the hole to insert another fuse; but it might happen that the fire is smouldering along the hemp, and either in the process of picking, or spontaneously, the whole might explode with fatal effect. The metallic safety fuse, in which a cylinder of iron is charged with fine powder, and drawn out into a coil, is free from this liability, but other objections might apply, and, it is therefore, necessary to test its value.

Mr. Taylor next explained the steam gauge exhibited, and which was being tried at the Falmouth Docks. The steam acts on a diaphragm of prepared India rubber, to which a vertical rod is attached, carrying a racket acting on a heavy pendulum. The effect is measured by a pointer on a dial plate.

The bitumenized pipes suggested a prolonged discussion, in which Mr. Appleton, of Torquay, Mr. Taylor, and Mr. R. W. Fox took part. Two questions arose as to their application to mines—their strength to bear the pressure of a high column of water, and their liability to be choked by deposits from the water, or corroded by the chemical agents it may contain; to which might be added, how far bitumen may be softened by continued exposure to the high temperature at the bottom of deep mines. Illustrations were cited of the tendency to deposit in iron pipes. Mr. Appleton stated that the soft water from the Moors of Devonshire, had, in a few years, left a deposit of 1¼ inch thick, but the iron underneath was uninjured. Mr. R. W. Fox stated that in some of our mines, the pumps had been reduced by deposit to half their diameter; while in other cases the iron had been changed by chemical agents to a substance like plumbago, which might be cut with the nail.

Mr. Charles Fox announced that Capt. W. Richards would give £5 towards prizes for boring machines. Mr. Taylor described the machine used in boring the tunnel through Mount Cenis, which separates the stones in blocks, by boring lines of holes around them. Its effect was stated to be satisfactory. Mr. Crease had informed him that he had invented a machine of whose effects he was very sanguine. It was to be worked by a steam-engine, and great doubt was expressed as to the practicability of applying conveniently, such a power in sinking shafts and driving levels. It was finally resolved to request the Committee of the Society to offer premiums for the best report on the use of mechanical means for boring holes underground.

INSTITUTION FOR THE BLIND.

The Annual Meeting of the supporters of the scheme for "Itinerant Teaching of the Blind in the County of Cornwall," was held in the Committee-room at half-past six in the evening. The chair was taken by Mr. Charles Fox. In the absence of the secretary, the Rev. E. Tippett, the report of the committee was read by the Rev. Saltren Rogers.

In the evening there was again a full attendance, in the hall and Mr. W. Carne having taken the chair, the Rev. F. H. Scrivener, M.A., delivered an excellent lecture, about an hour and a quarter long, entitled "A few thoughts on the love of learning," which was attentively listened to by a very numerous and delighted audience. This closed the proceedings of the first day.

SECOND DAY—WEDNESDAY.

The programme of proceedings appointed for to-day included, in addition to the exhibition, which was opened at eleven o'clock, a variety of matters amply sufficient to occupy the attention and time of both visitors and the committee of the society.

NEW PATENT METALLIC SAFETY FUSE.

The first thing fixed for the morning, was the testing of the New Patent Metallic Safety Fuse, invented by Mr. Victor, of Wadebridge, and to show its applicability to mining purposes, and its greater security to the lives of miners. The experiments were appointed to take place at the Falmouth Docks. About eleven o'clock, a number of the leading members of the Society and gentlemen interested in the mining of the county assembled at the place indicated, and the new fuse was exhibited by the patentees. The fuse is about the thickness of a straw, the principal apparent difference between it and the fuse hitherto in use, apparently being that instead of the usual covering of hemp and paper, the combustible material is enclosed in a leaden tube or small pipe, and although not nearly so thick as the old fuse, the charge of powder or composition is much greater. Various questions were put to Messrs. Victor and Polglaze by the gentlemen present, relative to the advantages of the fuse, the greater security which it afforded, its cost, &c., and it was explained that owing to the increased quantity of the combustible material, the danger of its being broken or severed in the process of tamping was less, and the risk of accident to the miner diminished; that even if it should be flattened and injured by tamping, that would not prevent it from exploding the charge; and that its price would not be greater than that of the present fuse. In order to test it thoroughly, Mr. Richard Taylor took a piece and beat it flat in the middle, injuring it as much as could well be done during the tamping of a hole, but on its being fired the piece burned through to the end. Three holes which had been bored in the rock were then charged, and three pieces of the fuse put into them, one of them being battered and flattened. On being fired, they exploded, those in which the uninjured fuse had been put almost simultaneously, and the latter in a moment after. The trial was considered to be perfectly satisfactory.

EXPLOSION BY MAGNETO-ELECTRICITY.

Some experiments were next tried in the firing holes by magneto-electricity, with the fuse invented by Professor F. A. Abel, F.R.S., director of the chemical establishment of the war department. The experiments were conducted by Mr. Brown, Professor Abel's assistant, aided by Mr. Robert Hunt. The electric machine employed was one which has been invented by Professor Wheatstone. A hole was first fired at a distance of about 150 yards, the discharge taking place almost instantly on the wire being connected with the electrical machine. Next, three damp holes were charged, but owing to the imperfect nature of the arrangements that could be made at the time for the exclusion of wet from the powder, only one of them exploded. This failure, however, was in no way owing to the inefficiency of the fusee, which is extensively employed in engineering and ordinary blasting, all the testing of artillery at Woolwich being made with them; but to the cause which has been stated.

ATMOSPHERE OF THE SUN.

About one o'clock, on the return of the party from the docks, the chair in the hall was taken by Mr. Charles Fox, who invited Mr. Hunt to make some observations on the experiments made by Bunsen and Kirchhoff, on the nature of the luminous atmosphere of the sun, remarking that this was a subject on which that able professor could speak with much authority; it was a subject with which he was eminently conversant, as many persons present, who had heard him lecture in that hall had reason to know.

Mr. Hunt began by remarking that the meeting yesterday was much interested at learning that a young lady had, during the past twelve months, been making diligent observations on the dark spots on the sun's disc. That a young lady should carry her observations so far was very interesting; but it was especially interesting that she should have observed so well. (Hear.) He had now been asked to give a short account of discoveries recently made in connection with a very interesting subject—the physical condition of the solar disc. On previous occasions, he had, when lecturing in that room on the phenomena of the sun's rays, spoken of the solar spectrum; but at present he intended to limit his remarks to one or two points only, in connection with that subject. Mr. Hunt then spoke of the analysis of light into the seven colours, of which, according to the Newtonian theory, it consisted, and of the power to re-constitute white light by the combination of the prismatic colours. He then proceeded to remark that if the prismatic spectrum was viewed through a magnifying glass, it was found to be crossed by a number of dark lines, first observed by Dr. Wollaston and by Frauenhauffer, a German physicist. Various theories have been advanced to account for these dark lines. Among them was one resulting from the following experiments:—If instead of using sun-light for the production of the spectrum, we employed artificial light, and particularly if we use such an artificial light as would produce a spectrum of but one colour, it was found that the lines, which had been referred to, varied in colour according to the nature of the material ignited for the prodúction of light. Thus the burning of sodium produced an intense yellow flame, with a spectrum consisting merely of a yellow band. By the burning of strontium or lithium, the spectral band produced was red; and by combustion of iron, the line produced was of a light-brown colour. By means of electric apparatus, metallic wires—gold, silver, and copper—could be burnt, producing both light and spectral images of intensely bright colours. Mr. Hunt then spoke of the shadows produced by such intense lights, when a light or flame—as for instance, that of a candle was interposed—and stated that the volatilization of sodium between the light of burning sodium and its spectrum would darken the previously bright yellow lines; and the same way the spectrum resulting from combustion of iron was darkened by the volatilization of iron, and consequent interposition of a ferruginous atmosphere between the flame and the spectrum. It was on such observations as these, and on deductions made from them, that Kirchhoff and Bunsen had inferred that the sun is made up of materials similar to those of our globe, but in a state of intense incandescence, and the recent investigations of philosophers, especially on the occasion of the late total eclipse, went to prove the existence of something like a flame-like envelope about the sun—as if the luminous globe we see, was flame surrounding an incandescent mass, comprising among other constituents, iron, sodium, lithium, magnesium, &c. He could not now enter on full details of such a subject; but his hearers might feel assured that such philosophical investigators as Bunsen and Kirchhoff, and Tyndal, and others, who supported this theory were not men to be led away by mere vague speculations. The deductions which these men had made from careful inductions might, on the contrary, be regarded as expressions of absolute truth; so that at the distance of 90 millions of miles, the human mind was enabled, with the aid of science, to reach as it were, the sun's enormous mass and to analyze its parts, in much the same way that a Cornish miner would detect the component parts of a piece of ore. Mr. Hunt concluded with some eloquent sentences on the still further advancement of human intellect yet to be obtained, and on the duty of promoting all proper means of such advancement.

Mr. Hunt next, by the request of the Chairman, made announcement that in the course of the afternoon, there would be in the hall, an exhibition of the power of magneto-electricity in the effecting of numerous simultaneous explosions, by means of a single battery on the platform, acting on fuses. He explained, both popularly and scientifically, the nature of such a magneto-electric apparatus, and said the advantage of its application to blasting purposes was, mainly, that any number of explosions might be effected, and at any distance from the battery, and from each other. The experiments in the afternoon would be conducted by Mr. Brown, of the Royal Arsenal, Woolwich, assistant to Professor Abel, director of the chymical establishment of the war department.

The CHAIRMAN said, as the subject of magnetism had been mentioned, he would avail himself of the opportunity of referring to an important scientific observation made by a youth. When Professor Wheatstone was first pursuing his experiments with reference to the electric telegraph, he was not aware that the electric circles could be completed through the earth, until a youth (now no more) making experiments in a garden, was surprised to find that the circle was completed, though he used but one line of wire. If that discovery had not been made, the difficulty of effecting electro-telegraphic communication across the Atlantic would have been more than doubled, inasmuch as there must have been two wires instead of one.

PROPOSED ITINERANCY OF THE SOCIETY.

At twelve o'clock, a meeting was held in the committee-room, in compliance with a resolution passed by the society in the month of July last, to consider the desirability of holding the exhibition of the society next year at Liskeard. Mr. William Carne was called to the chair, and at his request, Mr. SYDNEY HODGES read the resolution in question. It stated that the meeting held on the 8th of July last, a discussion took place as to the desirability of holding the exhibition in 1862, at Liskeard, and letters having been read from Mr. J. J. Rogers, and the Rev. T. Phillpotts, expressive of their opinion in favour of the proposal, it was resolved that a special general meeting should be held on the second day of the exhibition, for the purpose of considering the propriety of holding the society's exhibition for 1862 elsewhere than at Falmouth.

The CHAIRMAN said that having heard the resolution, it remained with the meeting to say whether they considered they were sufficiently numerous to entertain the question then, or if they thought that, seeing so many of the leading members of the society were engaged elsewhere, it would not be better to postpone the question till next year.

Mr. GARLAND, being appealed to for his opinion, stated that he thought the best course would be to adjourn the question, and he should be happy to move a resolution to that effect, if it met with the approval of the meeting. He then moved that the discussion of the question of holding the exhibitions of the society in other parts of the county be deferred till the exhibition for 1862.

Mr. W. H. BOND had great pleasure in seconding the motion.

The resolution was then put and carried unanimously.

Mr. BOND said he was glad that the resolution had been agreed to with such unanimity, because next year they should be better able to afford some information as to the time when the railway between Falmouth and Truro would be completed. When that was done, the great difficulty in attending at Falmouth would be removed; and thought it was not necessary to say anything to induce the inhabitants of Cornwall to attend the exhibitions of the society, as they had always done so most numerously—

The CHAIRMAN—And this year more so than ever—at least it appears so by the receipts.

MINERS' ASSOCIATION OF CORNWALL AND DEVONSHIRE.

The first annual meeting of this association was held at two o'clock, in the committee-room of the Polytechnic Society, and was numerously attended; there being apparently between sixty and seventy present.

The President, C. Fox, Esq., read a long and able address, which was followed by an elaborate report of the progress of the association, from Professor Hunt, the general hon. secretary. After this several papers of great value and interest were read. The proceedings closed with a vote of thanks to the President, and to Professor Hunt.

During the afternoon, the new portable action fire-engine and force pump "The Little Wonder," exhibited by Messrs. Blenkhorn, Shuttleworth, and Co., of Spalding, was tried in front of the Church, and acted most efficiently, working with a power equal to that of engines of much larger size, constructed on the old principle, and only requiring four men to work it. So portable is the machine, that one man can take it through the passage of any ordinary house.

The Hall was opened in the evening; but there was no lecture, nor were there any platform proceedings.

THIRD DAY—THURSDAY.

The exhibition was opened at ten, and at twelve, objects of interest were pointed out, and explanations of them given by Mr. R. Taylor, who kindly presided, and by Mr. Sydney Hodges, the secretary. Mr. Fox, and Mr. Tilly, also addressed the meeting.

In the evening the Hall was again well filled, and Mr. J. S. Phene, of London, delivered a long and interesting lecture on the Physics of the Crust of the Earth.

On Friday, Mr. R. Taylor, having kindly placed the Sydney steamer at the disposal of the members, an interesting excursion to the Helford River took place. The day was most pleasantly occupied by an exploration of the natural history of the coast, and an inspection of the beautiful scenery of the neighbourhood. The weather which had been so favourable all the week still continuing fine.

On Saturday, the Hall was again opened, and the proceedings of the week terminated by a lecture in the evening from Mr. Hodges, on "The love of nature, and its bearing on art and science." Mr. R. Taylor occupying the chair.

MECHANICAL DEPARTMENT.

Judges.—Messrs. R. R. Broad, C. Browne, R. W. Fox, Alfred Fox, John Hocking, John Hocking, jun., J. R. Kellock, M. Loam, More, J. Poole, jun., J. B. Read, N. Sara, J. Sims, R. Taylor, W. H. Bailey.—Patent steam gauge, first bronze. Gmelin's flower and fruit gatherers, honorable mention. M. Wigzell's patent spiral screw nail, first bronze medal. Miss H. Phillips's observations on spots in the sun, £2. Lieut. Robinson's electro-types, second bronze. Price's patent ne plus ultra safe, honorable mention. W. Dustin's communicator to railway guard, £2. W. Hoskin's model steam engine, first bronze medal. Capt. Gray's traversing protractor, parallel rule, and plotting scale combined, first bronze medal. P. Thomas's inlaid work box, 10s. F. Ayckbourn's patent life preserver, first bronze medal. S. Terrill's rifle camp stove, £3. W. Semmons's case of minerals, 10s. Powis James and Co.'s patent tenoning and mortising machine, first bronze medal. N. Sara's double action pump, first bronze medal. T. B. Jordan's improved miners' dial, 1st bronze medal. W. H. Wilton's levelling instruments, honorable mention. Young's bitumenized pipes, first bronze medal. Mrs. C. Paine's artificial stone and building bricks, honorable mention. Rust and Co's patent tubular piano-forte, first bronze medal. Weston's patent differential pulley blocks, first bronze medal. G. Beer's model of Agamemnon and Niagara laying the Atlantic cable, £2. Blinkhorn, Shuttleworth and Co.'s patent portable fire-engine, first bronze medal. Wheeler, Wilson and Co.'s lock stitch sewing machine, silver medal. Phillips's fire annihilator, honorable mention. R. Pearce's serpentine tables, £2.

FINE ARTS DEPARTMENT—AMATEURS.

Judges.—Mr. W. R. Hicks, Mr. S. Hicks, Rev. T. Phillpotts, Mr. W. Williams, Miss A. M. Fox, Mrs. Genn, and Miss Stirling.—Our fine days are over, T. H. Mitchell, Eton Villa, Plymouth, prize, £1. Portfolio of sketches from nature, Miss M. L. Scott, Plymouth, £1. Medallion in Plaster of Paris, G. Petherick, £3. Evening study at Penzance, Falmouth, B. Strongman, first bronze medal. The Land's End, Miss Mansell, 10s. Mount's Bay, Miss Bennett, Woodlane-terrace, £1. Vase and fruit from nature, and chrysanthemums ditto, J. Thomas, Penzance School of Art, first bronze medal. Original design from nature, J. Thomas, 5s. Lemons from nature, Sophia Rogers, Penzance, £1. Apple blossom, ditto, Margaret Rogers, School of Art, £1. Original design, C. Matthews, aged seventeen, ditto, 5s. Cottage near Torquay, Mrs. Warner, Torquay, second bronze medal. Pennance Point, Master Pengelly, 10s. Bunch of flowers from nature, Miss Hocking, Redruth, 10s. Ornamentally carved chair—original design—Joseph Hall Callaway, Bodmin, £1. Scene from off Dover, Capt. Raverty, 10s. Scene in Devonshire, F. Townshend, £1. Pair of tables in serpentine and steatite, W. Pearce, Truro, £2. A. Saunders, Plymouth, specimens of marbling,

&c., bronze medal. Wax flowers, Mrs. S. Hodges, 10s. Book of etchings, Miss Mansell, second bronze medal. Six lithographs from original drawings on stone, Miss B. Squire, Falmouth, £1. Furze bush from nature, Miss Annie Hockin, Penzance School of Art, 10s. Ditto, ditto, Miss Martha Pool, ditto, 5s. Design from copy, G. Matthews, 16, ditto, 5s. Apples from cast, E. C. Farley, Truro, 15s. Laurel and ivy branches from nature, H. Wing, ditto, 5s. Original design from nature, E. Griffiths, 5s. Girls carding wool, Miss Melvill, Ethy, first bronze medal. Kenwyn Church, R. H. Carter, Truro, £1.

SCHOOL PRODUCTIONS.

Judges.—Rev. St. Aubyn St. Aubyn, Mr. W. H. Bond, Mr. R. Broad, jun., Rev. C. Rumball, Mr. J. Cady, Rev. G. Edgecombe, Mr. R. T. Hall, Mr. J. Ludgater, Mrs. Rogers, Mrs. W. Rogers, Miss Thompson, Rev. Saltren Rogers, Miss C. Fox.—Cattle, Mary Seccombe, Woodlane-terrace, done when 14, prize 2s. 6d. Book of pencil drawings, Edward Seccombe, age 10, prize 7s. 6d. Book of outlines, Edmund Teague, age 14, 7s. 6d. Geometrical outlines, John Teague, Buller's-row Redruth, age 13, prize 2s. 6d. Chalk drawing, girl and hoop, F. Courtis, Redruth, age 13, prize 2s. 6d. Flowers in sepia, G. Morgan, Redruth, age 12, prize 2s. 6d. Book of drawings, G. M. Hicks, Bodmin, 5s. Book of drawings, William Hicks, Bodmin, 5s. St. George's Church, Truro, J. Pargiter, 5s. Head from cast, T. L. Kelly, Truro, £1. Outline by three boys, of the British school—design by the master—prize 10s. Design in outline, S. Terrill, age 12, prize 10s. Series of drawings, from Truro Central School, ages 10 to 14, prize 5s. Series of outlines, Emily Christiana, Falmouth British school, prize 2s. 6d. Book of outlines, J. H. Deeble, age 13, Falmouth British school, prize 7s. 6d. Female head, R. H. Tuck, Camborne, aged 16, prize 5s. Drawings of locomotives, Master J. H. Barclay, St. John's Infant school, Truro, prize 7s. 6d. Book of drawings, Master J. H. Barclay, prize 2s. 6d. England and Wales, G. Corfield, St. Day, 7s. 6d. Copy book, G. Corfield, St. Day, 10s. Plan, C. Phillips, Kimberley school, Falmouth, 2s. 6d. Map of Scotland, G. M. Hicks, Bodmin, 5s. Map of Europe, W. M. Hicks, Bodmin, 7s. 6d. Map of British Isles, with descriptions of the physical features, &c., R. Jewell, £1. Map of America, Arthur Troup, Penrose Lodge, age 13, 10s. Copy book, T. Learwood, Wesleyan school, Penryn, age 13, 5s. Copy book, F. Hawke, Wesleyan school, Penryn, age 9, 7s. 6d. Specimens of writing from Truro British school, and Central school boys, 2s. 6d. Large folio of mechanical drawings, E. C. Hawkin, 10s. Map of British Isles, Truro British schools, Lucy Kelly, 2s. 6d. England and Wales, Truro British schools, Sarah Kelway, 2s. Specimens of writing, John J. Scammel, Budock school, age 14, 2s. 6d. Specimens of writing from Girls British school, Falmouth, Lucy A. Strongman, 2s. 6d.; ditto Jane A. Hosken, 2s. 6d.

NATURAL HISTORY.

JUDGES.—Rev. W. Rogers, Messrs. A. L. Fox, C. Fox, George R. Copeland, Nicholas Tresidder.—Book of drawings of grasses, Rev. Saltren Rogers, first bronze medal. A list of the principal wild plants in the neighbourhood of Falmouth, Edward Doble, 10s. Case of British butterflies and book of description, W. L. L. Fox, age 13, 7s. 6d.* Beetles of Falmouth, Charles Phillips, 5s. Herbarium, collected in Falmouth and neighbourhood, between March and September, 1861. F. Polglase, second bronze medal. 17 cases of stuffed birds, J. Jennings, Penryn, £2. Case of butterflies and moths, Master J. H. Barclay, 7s. 6d. Collection of butterflies, R. G. Barclay, 2s. 6d. Ditto, Master C. Barclay, 2s. 6d. East India pheasant and two partridges, Mr. M. Tresidder, first bronze medal.

NAVAL ARCHITECTURE.

JUDGES.—Mr. H. Bradfield, Capt. Eden, R.N., Mr. J. Hughes, H.M.C., Capt. W. Robinson, R.N., Mr. F. H. Thomas, Mr. J. Trethowan, Mr. Tucker, R.N., Capt. Wake, R.N.—Drawing of H.M.S. Constance, £1. W. Paynter, model of vessel in frame, £1 10s. W. Gill, case of models, £1 10s. W. Fletcher, model of White's quarter boat, 10s. J. Christophers, model of schooner, £1. Robert Flower, model of steam yacht, £1. R. Hancock, model in frame of 50-gun frigate, £1. J. N. Saxby's patent sphereograph, or mariner's ready reckoner, first bronze medal. A silver medal awarded to Mr. R. Hancock, of H.M. Dockyard, Devonport, for a model of 38 feet barge or pinnace, showing the method of transporting anchors, &c., from H.M. ships, was accidentally omitted in the list of prizes, last year.

PLAIN AND FANCY WORK.

JUDGES.—Mrs. Blight, Miss Rogers, Miss Vigurs, Mrs. Reynolds, Miss Phillpotts, Miss Molesworth.—Patchwork quilt, H. Coombe, Wellington-terrace, 5s. Pair of knitted socks, Susan Ann Cock, Phillack National school, 10s. Small shirt, 2s. 6d. Bird and flowers—pear worked on paper by an octogenarian, Elizabeth Burton, Falmouth, 2s. 6d. Four pairs of stockings, 5s.; gloves, 2s. 6d., C. Nicholas, totally blind. Knitted stockings, Emma Faull, 2s. 6d. Shirt of the most approved form, Eleanor Hosking, 7s. 6d. Pair of sleeves and collar (lace work), M. A. Gregory, Truro, 3s. Two strips of work by a crippled girl, M. M., Mawnan school, 2s. 6d. Flannel petticoat, Jane Hosking, Falmouth, 2s. 6d. Girl's dress, cut out and made by Jane Davis, ditto, 2s. 6d. Linen chemise, Mary Treglown, ditto, 2s. 6d. Ships in worsted work, C. Tippet, 2s. 6d. Globe of paper flowers, Miss J. A. Buckett, Falmouth, 5s. Linen shirt, by a poor woman, 5s.

* This would have obtained a higher prize, but the book of descriptions was unfortunately overlooked until after the Judges' decision.

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PHOTOGRAPHY AND ARCHITECTURE.

MANUFACTURES IN PORCELAIN, PARIAN, ENCAUSTIC TILES AND GLASS.

JUDGES.—Rev. T. Phillpotts, Mr. W. R. Hicks.—Series of 11 stereograms, Rev. F. E. Gutteres, £1. Holiday in the woods, H. P. Robinson, Leamington, second silver medal. Design for new church, Torquay, first bronze medal. First bronze medal—claret jug, engraved, ivy, silver-mounted, Messrs. Apsley, Pellatt, and Co., Falcon Glass Works, Blackfriars, and Baker-street, Portman-square, London. First bronze medal—round tray, white enamel border, subjects painted by hand, Messrs. H. Minton and Co., Stoke-upon-Trent, Staffordshire.

Contributions to the Flora of Falmouth.

By W. P. Cocks.

'Tis born with all: the love of Nature's works
Is an ingredient in the compound man
Infused at the creation of the kind.
And though the Almighty maker has throughout
Discriminated each from each, by strokes
And touches of his hand, with so much art
Diversified, that two were never found
Twins at all points—yet this obtains in all,
That all discern a beauty in his works,
And all can taste them: minds that have been formed
And tutored with a relish more exact,
But none without some relish, none unmoved.
It is a flower that dies not even there
Where nothing feeds it: neither business, crowds,
Nor habits of luxurious city life,
Whatever else they smother of true worth
In human bosoms, quench it or abate.

Cowper.

To a mind thus disposed, says Dr. Beattie, no part of creation is indifferent. In the crowded city and howling wilderness, in the cultivated province and solitary isle, in flowery lawn and craggy mountain, in the murmur of the rivulet and in the uproar of the ocean, in the radiance of summer and gloom of winter, in the thunder of heaven, and in the whisper of the breeze, he still finds something to rouse or to soothe his imagination, to draw forth his affections, or to employ his understanding. And from every mental energy that is not attended with pain, and even from some of those that are, as moderate terror and pity, a sound mind derives satisfaction; exercise being equally necessary to the body and the soul, and to both equally productive of health and pleasure. This happy sensibility to the beauties of nature should be cherished in young persons. It engages them to contemplate the Creator in His wonderful works; it purifies and harmonises the soul, and prepares it for moral and intellectual discipline; it supplies a never-failing source of amusement; it contributes even to bodily health; and, as a strict analogy subsists between material and moral beauty, it leads the heart, by an easy transition, from the one to the other, and thus recommends virtue for its transcendent loveliness, and makes vice appear the object of contempt and abomination.

GRASSES.

——— "The penetrative sun,
His force deep darting to the dark retreat
Of vegetation, sets the steaming power
At large, to wander o'er the vernant earth
In various hues; but chiefly thee, gay green!
Thou smiling nature's universal robe!
United light and shade! where the sight dwells
With growing strength, and ever new delights."

THOMSON.

Grasses, says *Paley*, are nature's care. With these God clothes the earth; with these He sustains its inhabitants. Cattle feed upon their leaves, birds upon their smaller seeds, men upon the larger; for few readers need be told that the plants which produce our bread-corn belong to this class. In those tribes which are more generally considered as grasses, their extraordinary means and powers of preservation and increase, their hardiness, their almost unconquerable disposition to spread, their properties of reproduction, coincide with the intention of nature concerning them. They thrive under a treatment by which other plants are destroyed. The more their leaves are consumed, the more their roots increase; the more they are trampled upon, the thicker they grow. Many of the seemingly dry and dead leaves of grasses revive and renew their verdure in the spring. In lofty mountains, where the summers are not sufficient to ripen the seeds, grasses abound, which are able to propagate themselves without seed. It is an observation, likewise, which has often been made, that herb-eating animals attach themselves to the leaves of grasses, and, if at liberty in their pastures to range and choose, leave untouched the straws which support the flowers.

GRAMINACEÆ.

Florets, little flowers, usually perfect, sometimes imperfect, sometimes neuter, with stamens or pistils, solitary; one or more imbricated on a common axis or rachis:—destitute of true calyx or corolla; surrounded by a double set of bracts, the outer constituting the glumes or husks (calyx, Linn.,) the inner, glumellas or paleæ (corolla, Linn.,) the whole constituting a spikelet.

Perianth, Brown; corolla, Linn. (The calyx or corolla, or one or other of these organs,) glumaceous; the fertile florets usually

The universal verdant "carpet," which strikes foreigners with such surprise and pleasure on arriving in England, which spreads over the country, gives it as individual a character as the palm groves of the equator, or the pines of Norway, is composed chiefly of grasses; and the title of Emerald Isle, bestowed on Ireland from the same cause, is, we believe, a solitary instance of an epithet being given to a country from the character of its vegetation alone. Mr. Curtis found the following grasses, &c., in a sod of grass taken from Selborne Common:—Plantago lanceolata, Agrostis capillaris, Avena flavescens, Dactylis glomerata, Festuca duriuscula, Poa annua, Cynosurus cristatus, Trefolium repens, Crepis tectorum, Achilea millefolium, Galium verum, Hypochœris radicata, Hieracium pilosella, Thymus serpyllum.

Rogation week is called *grass week*, from the appetite being restricted to salads and greens.

The Colosseum (at Rome) is now the favourite haunt of botanists, for nowhere can their innocent science be so well studied as amongst the ruins of that building which has been called "the charnel-house of the world." No less than four hundred and twenty-three species of plants are found growing here, including two hundred and fifty-three genera and illustrations of sixty-six of the natural order of plants. There are *fifty-nine species of grasses*, forty-seven of the syngenesious plants, and forty-one of the pea tribe. This is in an enclosed space of six acres of ground, a limit that does not include the walls and ruins.—*Piedmont and Italy*, by D. Costello, Esq., May, 1861.

of two dissimilar glumallas; the lower or outer one simple, mostly keeled, or with a midrib, extending into a point; the inner or upper with two lateral or dorsal ribs; occasionally one or both absent.

Stamens (the fertilising organs of a flower,) hypogynous—inserted beneath the pistil; usually definite—very rarely indefinite; if six or three, placed round the ovary; if fewer than three, placed next to the outer glumella.

Anthers (organs which contain pollen,) two celled, linear, prominent, pendulous, bifid, versatile; attached by their back near the middle.

Ovary (or germen, the hollow part of a pistil, containing the ovules,) superior, single celled, with one ovule, usually with two, rarely one, or even none, minute hypogynous scales, called lodicules or abortive stamens.

Styles (stalks supporting stigmas,) two; rarely one or three; simple or bifid.

Stigmas (tops of styles,) rough or feathery; sometimes branched, or compound.

Pericarp (seed-vessel,) closely incorporated with the seed; hence the fruit receives the name *caryopsis*—signifying a resemblance to a seed.

Embryo (rudiment of the future plant,) lenticular, external, lying on the side of the base of the starch, called the albumen.

Stems or culms, cylindrical, generally hollow, mostly simple, herbaceous, jointed, varying in length.

Leaves, one to each joint, with a sheathing petiole (having a foot stalk); slit longitudinally on one side, usually with a ligula at the apex.

Flowers, solitary or in spikelets, which are panicled or spiked.

Class II.—DIANDRIA.

Plants bearing flowers with two stamens.

Order II.—DIGYNIA.

Two pistils.

Genus—ANTHOXANTHUM, Linn. Spring-grass.

Spikelets of one perfect central floret, and two outer neuter; glumes two, unequal, smooth, sharp-pointed; glumellas four, two inner ones awnless; the outer ones awned.

A. odoratum, Linn. Sweet-scented spring-grass. Perennial. Flowers in May, June. Common. This grass is of little importance for its nutritive qualities, but is much esteemed for the sweet odour of its leaves. In drying it smells like wood-ruff, but scentless while growing, and is the principal cause of the fragrance of meadow hay. This odour arises from its containing *coumarin*, a substance nearly allied to the fragrant resins. It is not improbable that the hay fever, to which many susceptible people are liable, may be owing to the presence of this substance in the air in unusual quantity during the period of haymaking. This peculiar disease, *hay fever*, is marked by its recurrence in the beginning of the summer, about April, and May, and June, and continues several weeks. The symptoms are a redness, heat, pricking and running of the eyes, discharge from the nose, itching of the ears, cough, pricking about the throat, and copious expectoration. In some cases, in addition to all this, there is a great constriction of the chest, as in *asthma*—in fact, *asthma*. This plant is used for making straw plat.

"By the careful cultivation," says Cobbett, "of those grasses which are more particularly adapted to this purpose (straw plat for bonnets, &c.,) a constantly improving material is being produced, while greater skill is displayed in the manner of its preparation."

Class III.—TRIANDRIA.

Plants bearing flowers with three *stamens.*

Order I.—MONOGYNIA.

One *pistil.*

Genus—NARDUS, Linn. Mat-grass.

Spike simple, unilateral; spikelets one, flowered; glumes none; glumellas two; the outer one keeled, with a long subulate point.

Schrank celebrates this deep-rooted grass as a safe support to the hands of the Alpine botanist in precipitous situations, though it renders his path very slippery.—*Sir J. E. Smith.*

N. stricta, Linn. Common mat-grass. Wire-bent. Perennial. Flowers July. Rare. In the north of England it is used in making mats, bonnets, hats, &c.

Order II.—DIGYNIA.

Two *pistils.*

Spikelets containing one perfect flower, and disposed in a panicle or raceme.

Genus—ALOPECURUS, Linn. Foxtail-grass.

Glumes two, nearly equal, oval, acute, about as long as the floret; glumella one, concave, with a dorsal awn about the base; caryopsis ovate, loosely covered.

A. pratensis, Linn. Meadow fox-tail-grass. Perennial. Flowers May. Not common. An early and productive grass; nutritive and grateful to ruminating animals. *Mr. Curtis* observes:—"It grows naturally in a moist soil, and is hence best adapted to improve very wet ground, that may be drained of superfluous moisture, or to form or ameliorate meadows that have a moist bottom, and are not apt to be burnt up in dry weather." *Professor David Lowe* says:—"This plant, on account of its early growth, its permanence in the soil, and the quantity and value of its produce, deserves to be cultivated when the land is intended for perennial herbage. Employed in making plat for hats, bonnets, &c.

A. geniculatus, Linn. Floating fox-tail grass. Perennial. Flower, June, July. Ditch Gwyllyn Vase, &c. Mr. H. Bastian, found it at Glendurgan, &c.

Genus—PHLEUM, Linn. Cat's-tail Grass.

Glumes two, equal, pointed, longer than the floret; glumellas two, concealed, membranaceous, awnless; caryopsis free or with a short terminal awn.

P. pratense, Linn. Common cat's-tail grass; Timothy's grass; Soldiers' feathers, &c. Perennial. Flower, June,—October. Common. According to *Professor Lowe*, it is not a peculiarly good hay-grass, from the wiryness of its stem and the shortness of its aftermarth. It is of the greatest use when the object is to procure a sward of permanent herbage. In the *Gentleman's Magazine*, it is stated that this plant is American, and grows in the swampy ground of Virginia, without cultivation, to a great height. The seeds were carried from Virginia to North Carolina, by one Timothy Hanson, an agriculturist. Hares are remarkably fond of this grass, and it is eaten without reserve by cattle in general. The straw of this plant is used in making plat for hats, bonnets, &c.

Mr. Cobbett has observed that the circumstance deserving attention, was the great advantage that this manufacture (plat for bonnets, &c.,) possesses in not requiring the collecting together of a number of people. All may be performed by a single pair of hands—no power or machinery is wanted—no other capital than can be commanded by any labourer's wife in the kingdom. The boiling of a pot of water is the sole expense necessary to furnish her and her children with work for a part of the winter, and the only engines requisite are their fingers.

GENUS—PHALARIS, LINN. CANARY GRASS.

Glumes two, unequal, keeled, erect, longer than the floret glumellas two, hairy, awnless; neuter florets one or two, coriaceous, rudimentary, sessile; caryopsis ovate, invested by the hardened glumellas.

P. canariensis, Linn. Common Canary grass. Annual. Flower, June,—August. Very rare, (a dozen examples, certainly not more, have been met with during a residence of nearly twenty years.) This plant is a native of the Canary Islands, naturalised in this country; and is cultivated in a few parts of the south, and chiefly in the Isle of Thanet, in Kent, for the sake of the seeds which are given to canary and other small birds.

P. arundinacea, Linn. Reed Canary grass; ladies' garters, &c. Patches of the variety with variegated leaves are to be met with growing in the "garden refuse," "muck-heaps," and fields in the rear of Thyde Terrace.

GENUS—AMMOPHILA, HOST. COMMON SEA-REED. MAT-GRASS.

Glumes two, unequal, keeled, diverging, longer than the floret; glumellas two, with a tuft of short silky hairs at the base; neuter floret one, rudimentary, membranous: caryopsis invested by the hardened glumellas.

A. arenaria, Linn. Common mat-grass. Perennial. Flower, July. Planted (not indigenous) in the sands, Swanpool, Mainporth, &c. This is one of the most valuable grasses for binding the sands of the seashore, and raising those sand-banks, which, are the chief defence of the country against the encroachments of the ocean.

Sand-banks, says *Burnet*, when fixed by the mat-grasses become gradually covered by vegetable mould, and as the sea recedes they gradually migrate to the new formed shores, leaving the richer soil to other species, and fix succeeding banks as they are successively thrown up. The sand-hills on the French coast, between Dunkirk and Boulogne, especially about Calais, are covered with these mat-grasses, which keep them firm, and the banks on our Flintshire shores, in the parish of Llanissa, are also similarly fortified. The Dutch owe the existence of no inconsiderable part of their country to the defensive power of the *murah* or *mat-grasses*, which they call *halm*,

The situation of the town of Hull is such, that, in the opinion of those conversant with the subject, it would long since have been washed away, and its site covered by the sea, were it not protected by *Spurn-point*, which receives the full force of the swell, and breaks its power before it reaches Hull. *Spurn-point is a sand-bank, at first fixed, and still preserved by the roots of the mat-grass.* The long creeping roots fix the loose and flowing sands, which would otherwise advance with fatal sureness.

Much land has thus been overwhelmed on the Biscayan shores; in Egypt vast tracts of fertile country have been thus converted into deserts; near Downham, in Suffolk, the sand-floods have encroached five miles within the last century; and in Scotland hundreds of acres have been utterly destroyed. I have more than once, says *Pennant*, on the eastern coasts of Scotland, observed the calamitous state of several extensive tracts, formerly in a most flourishing condition, at present covered with sands, unstable as those of the deserts of Arabia. The parish of Furvie, in the county of Aberdeen, is now reduced to two farms, and above £500 a-year lost to the Errol family, as appears by the oath of the factor in 1600, made before the Court of Session, to ascertain the minister's salary. Not a vestige is to be seen of any buildings, unless a fragment of the church. The Conbin Estate, near Fores, which was worth once £300 per annum, has long been overwhelmed with sea. The church of Perranzabuloe or Piran-zabulo, in the Hundred of Pydar, Cornwall, met with a similar fate, and was entombed nearly 800 years. The *Rev. C. T. Collins* observes, "while it points with undoubted certainty to the past distinction of the ancient church—its purity—its stability—its independence,—it tells moreover of aggression—repeated, insidious, long resisted aggression. It speaks of the ruinous effects of natural causes—of the overwhelming weight of the great Western Sea—advancing, invading year after year, this once fruitful district—and gradually breaking down all ancier barriers that for many ages successfully resisted the inroads of the restless Atlantic. It tells of the gradual *submersion of this devoted portion of Cornwall;* it points to the hillocks of sand, as the collected offscouring of the turbulent ocean, which the north-west wind, *the tyrant of this coast*, sweeping along with unceasing and accumulating rapidity, has spread over to *a great depth*, the once verdant meadows of this ill-fated parish. Like the city of *Vesuvius*, the church of *St. Piran* was buried, but not overthrown."

At Aberdeen and at Anglesey this grass is manufactured into door-mats, floor-brushes, &c. In the *Outer Hebrides* it serves many purposes in rural and domestic economy, being made into ropes for various uses, mats for pack-saddles, bags, mats, and vessels for preparing and keeping grain and meal; and lastly into hats. —*Edinburgh Philosophical Journal.*

In Sussex it is used for making beautiful table-mats and basket-work. Strange as it must appear, notwithstanding such lamentable ravages, the country people destroy this valuable grass, collecting it for the manufacture of various articles, and for fuel; thus removing their greatest protectors, the natural antagonists of moving sands. *B. Stillingfleet, Esq.*, recommended the sowing of this plant on the sandy wilds of Norfolk, that the matted roots might prevent the deluges of sand which that county experiences. This plant was so highly prized *on this very account*, in the reign of Queen Elizabeth, that Her Majesty, under very severe penalties, prohibited its extirpation; by the Stat. 15, Geo. II., c. 33, the like prohibition was extended to the

In 1842, *Cyrus Redding* stated, the parish of Piran-sabulo, is half-overwhelmed with the sand blown up by the sea. The manor of St. Piran has wholly disappeared beneath the deluge that has rolled over it. No less than three churches are recorded to have been built, and abandoned from this cause; and in 1835, a building was laid bare by the shifting of the sands, which some believe was the original church of *St. Piran.*

The chapel of St. Michael, on the banks of the Camel, is also called Porthilly Church; the village attached to it has long been overwhelmed by the sands. There were other chapels in this parish; one, the manor of Penmean, had a burying ground, which, in 1778, from the shifting of the sands, was exposed to view, and human bones, with rings, coins, and ornaments, from the time of Henry I. to Elizabeth, were found.

cutting of this valuable grass. *Gerard* observes, no cattle will eat or touch this vegetable, allotted for other purposes, subservient to the use of mankind.

Genus—GASTRIDIUM, Beauv. Nit-grass.

Glumes, two, membranaceous, ventricose at base, acute, entire, awnless, longer than the floret; glumellas two, membranaceous, abrupt, or toothed, with a long straight awn below the point; caryopsis invested by the hardened glumellas.

G. lendigerum, Beauv. Panick millet-grass. Annual. Flower, August. Rare. Bar, Mainporth. Mr. H. Bastian found it at Trefusis, St. Just, and Helford River. Useless as an agricultural grass.

Genus—AGROSTIS, Linn. Bent-grass.

Glumes two, acute, awnless, longer than the floret; glumellas two, unequal, longer than the glumes, membranous, tufted with hairs at the base; caryopsis free, oblong or linear.

AWNED.

A. canina, Linn. Bent-grass. Perennial. Flower, June, July. Common. Of no agricultural value. The straw of this grass is said to make good and lasting hats, bonnets, &c.

A. setacea, Curr. Bristle leaved bent-grass. Perennial. Flower, July, August. Rare. Miss E. Warren found it at Mylor; and Mr. L. Squire, Budock Bottom.

GENERALLY AWNLESS.

A. vulgaris, Wither. Fine bent-grass. Perennial. Flower, July, August. Common. Not palatable to cattle, as they never eat it readily, if any other kind be within their reach.

An elegant grass, says the poet *Burns*, which, in "soft weather," has its gracile and branched panicle beaded prettily with dew-drops.

"At dawn, when every grassy blade
Droops with a diamond on its head."

A. alba, Linn. Marsh Bent-grass; Black Couch-Grass; Fiorin-grass of Dr. Richardson, and the Irish agriculturists. Perennial. Flower, June, July. Common. A troublesome weed. Wild geese and ducks are fond of its stems and roots. The straw is employed in the making of bonnets, &c.

Spikelets containing two or three flowers and disposed in panicles, hairy at the base.

GENUS—AIRA, LINN. HAIR-GRASS.

Glumes two, unequal, as long as the florets, the outer one nerved; glumellas two, membranaceous, thin, hairy at base, the outer awned above; caryopsis smooth, loose in the glumellas.

A. cæspitosa, Linn. Turfy hair-grass. Perennial. Flower, June, July. Common. A wiry harsh grass, and is rejected by domestic cattle.

A. flexuosa, Linn. Waved hair-grass. Perennial. Flower, July. Not uncommon. Sheep are fond of it.

A. caryophyllea, Linn. Silver hair-grass. Annual. Flower, June, July. Common.

A. præcox, Linn. Early hair-grass. Perennial. Flower, May, June. Common.

None of the *Airæ* are cultivated. Some of them possess a degree of elegance, and are gathered for the purpose of ornamenting fire-places, &c., during the summer.

GENUS—KOELERIA, PERSOON. KOELERIA.

Glumes two, unequal, upper with several nerves, shorter than the florets; glumellas two, membranaceous, outer keeled, entire, pointed; caryopsis free.

K. cristata, Persoon. Crested hair-grass. Perennial. Flower, July, August. Not common. A grass of no value as food for cattle.

GENUS—MOLINIA, MŒNCH. MOLINIA.

Glumes two, acute, shorter than the florets, unequal, one nerved; glumellas two, outer one rounded on the back, glabrous, entire; caryopsis free.

M. cærulea, Mœnch. Purple melic-grass. Perennial. Flower, June, July. Not uncommon. It is stated that the butter of cows which are fed upon it is very rich and highly coloured. In some parts of England brooms are made of the stems, and the fishermen in Skye make ropes of them, which are found, by experience, to bear the action of the water well, without rotting. The straw of this grass is used in making plats for bonnets, &c.

GENUS—HOLCUS, LINN. SOFT-GRASS.

Glumes two, unequal; flowers two, one of them bearing stamens only, and awned; glumellas two, outer one awned; caryopsis covered by the hardened glumellas.

H. mollis, Linn. Creeping soft-grass. Perennial. Flower, July. Common. A troublesome and impoverishing weed, which it should be the study of the farmer to extirpate. *Mr. J. Hardy* observes, this grass occasions a considerable deal of trouble to the farmer, if the grounds infested with it are in any degree neglected. According to some, it is even more difficult to eradicate than quickens; as the latter rise in long, tenacious strings, which occasionally rot in the ground; whereas the root of the *Holcus* is excessively brittle, and the smallest section, like that annoying Convolvulus sepium, (great bind-weed) will propagate the pest anew.

H. lanatus, Linn. Meadow or woolly soft-grass. Perennial. Flower, July. Common. The hay which is made of it, from the number of downy hairs which cover the surface of the leaves, is soft and spongy, and disliked by cattle in general. In the north of Britain it is called the "rot-grass."

GENUS—ARRHENATHERUM, BEAUV. OAT-LIKE GRASS.

Glumes two, membranaceous, nearly equal, as long as the florets; the lower floret male, upper perfect; glumellas two, outer one awned below the point; caryopsis covered by the hardened glumellas.

A. avenaceum, Linn. Common oat-like grass. Perennial. Flower, July, August. Not common. A troublesome weed. The roots which are fibrous in the moister soils, become bulbous in the drier, and then the plant is with great difficulty extirpated. On many farms it is so abundant, that the roots are collected and destroyed with fire. According to *Sir H. Davy*, it contains more of bitter and saline matter than other grasses.

Flowers in panicles. Spikelets containing more than three flowers.

Genus—GLYCERIA, Smith. Sweet-grass.

Glumes two, unequal, oblong, obtuse, awnless; glumellas two, unequal, the outer ribbed, cylindrical, entire, abrupt, awnless; inner narrow, obtuse or notched, flat, membranous, two marginal ribs; caryopsis cylindrical, loose.

G. fluitans, Smith. Creeping floating sweet-grass. Perennial. Flower, June, July. Ditches, &c,, abundant. Cattle are fond of it. *M. Stillingfleet* observes, Mr. Dean, a farmer, at Ruscomb, Berkshire, assured him that a field always lying under water, of about four acres, was covered with this grass, that maintained five farm-horses in good condition from April to the end of harvest, without giving them any other kind of food, that it yielded more than they could eat. The seeds of this plant are gathered yearly in Poland, and from thence carried into Germany, Sweden, &c., and sold under the name of "manna seeds," where they are much used as food at the tables of the great, on account of their nourishing quality and agreeable taste—"like honey." In the north of Britain they are sold in shops, and are known by the name of "manna-croup." The seeds are said to be very sweet before arriving at maturity. The fine sharp bran is said to kill intestinal worms in horses.

G. distans, Smith. Creeping sea sweet-grass. Perennial. Flower, July, August. Found by Mr. H. Bastian, at Mainporth, 1856.

G. rigida, Smith. Hard sweet-grass. Annual. Flower, June. Pendennis and Pennance. Rare.

GENUS—TRIODA, BROWN. HEATH-GRASS.

Glumes two, nearly equal, ovate, keeled, acute, as long as the florets, awnless; glumellas two, unequal, ovate; the outer deeply cleft at the summit, with an intermediate short point; caryopsis oval, loose.

T. decumbens, Linn. Decumbent heath-gras. Perennial. Flower, July. Not uncommon.

GENUS—BRIZA, LINN. QUAKING-GRASS.

Glumes two, nearly equal, heart-shaped, obtuse, keeled, shorter than the spikelets, awnless; glumellas two, unequal, obtuse, awnless; caryopsis nearly orbicular, flat, united to the glumellas.

B. media, Linn. Common quaking grass; trembling-grass; "siller-tassels." Perennial. Flower, June, July. Not common.

B. minor, Linn. Little quaking-grass. Perennial. Flower, June, July. Cornfields. In some seasons plentiful, at others very scarce. These grasses are of little value to the farmer, and are generally gathered to ornament chimney pieces, &c.

The plants coming to head in May, occasioned the following English proverb, "*May, comes she early, come she late, makes the cow quake.*"

GENUS—DACTYLIS, LINN. COCK'S FOOT-GRASS.

Glumes two, unequal, narrow, lanceolate, acuminate, shorter than the spikelet, the larger keeled; glumellas two, lanceolate, the outer keeled, and awned at the summit; caryopsis oblong, loose, covered by the glumellas.

D. glomerata, Linn. Cock's foot-grass. Perennial. Flower, June, July. Common. A coarse but nutritive grass, of early and rapid growth. Oxen, horses, and sheep eat it eagerly. *Mr. Sinclair* states, that cock's foot-grass forms a part of the herbage of pastures most celebrated for fattening and keeping the largest quantity of stock in Devonshire, Lincolnshire, and the Vale of Aylesbury. To reap the benefit of its merits, says *Mr. Coke*, of Holkham, it must be sown on dry open land, and kept closely cropped, either with the scythe or by means of cattle. Introduced from Virginia, about the year 1780.

GENUS—POA, LINN. MEADOW-GRASS.

Glumes two, unequal, ovate, acute, shorter than the florets, awnless; glumellas two, unequal, the outer keeled, ovate, compressed, acute, awnless; caryopsis oblong, acute, loose.

P. trivialis, Linn. Rough stalked meadow-grass. Perennial. Flower, June, July. Common. A valuable grass, whether for pasturage or hay, yielding abundantly, though not particularly early. Two acres and a half of land near Salisbury, yielded ten tons of hay in one year. *Linn. Trans.* According to *Mr. Sinclair*, Oxen, horses and sheep eat it with avidity.

P. pratensis, Linn. Smooth stalked meadow-grass. Perennial. Flower June, July. Common. Inferior to the rough stalked meadow-grass in nutritious qualities. This species says *Mr. Sinclair*, exhausts the soil in a greater degree than almost any other species of grass; the roots being numerous, and powerfully creeping, become in two or three years completely matted together; the produce diminishes as this takes place.

Miss Sophia Woodhouse, U.S. America, received from the Society of Arts, in 1822, a silver medal and twenty guineas, for her specimens of plat made with the straw of this grass.

P. annua, Linn. Annual meadow-grass. Common. This little grass springs up everywhere in the absence of the gardener, flowering and ripening its seed at all seasons when not actually frozen. *Dr. George Johnston* observes, about Dunse it is called *causeway-grass* for a very obvious reason—its frequency in unfrequented streets. *Professor D. Lowe* remarks, the only case in which we can suppose this species deserving cultivation, is when other grasses had died out; and when, by sown on the sward of these grasses in spring or autumn, the annual meadow-grass might be expected to afford a growth of herbage in a few months.

P. nemoralis, Linn., Wood meadow-grass. Perennial. Flower, June, July. Trefusis and College Wood. H. Bastian.

Genus—FESTUCA, Linn. Fescue.

Glumes two, very unequal, lanceolate, pointed, shorter than the spikelet; glumellas two, unequal, the outer nearly cylindrical, pointed or awned; caryopsis oblong, loose.

F. pratensis, Huds. Meadow fescue. Perennial. Flower, June, July. Scarce. The leaves are succulent, and readily eaten by the larger pasturing animals. *Mr. Sinclair* states that in point of early produce, this grass ranks next to meadow fox-tail, and is much more productive. *Mr. Curtis* praises it highly as an agricultural grass.

F. loliacea, Smith. Spiked fescue. Perennial. Flower, June, July. Scarce. *Mr. Sinclair* considers this grass superior to the rye-grass, for the purposes of either hay* or permanent pasture.

F. ovina, Linn. Sheep's fescue. Perennial. Flower, June, July. Common. *Linnæus* states that sheep have no relish for hills on which it does not abound. This is one of the best grasses for bowling-greens and lawns; it is soft, fine, and does not require frequent mowing; it likewise roots deeply, and therefore keeps green in dry weather. The shepherds in the north put parcels of this grass in their shoes to preserve their feet from damp.

F. duriuscula, Linn. Hard fescue. Perennial. Flower, June, July. Common. This is one of the best of the dwarf sort of grasses, and withstands dry weather better than most others, and in combination with *F. pratensis and Poa trivialis*, forms excellent pasturage. It is acceptable to all kinds of cattle.

*In the time of *Romulus*, a handful of hay was used in his ranks instead of a flag; and his military ensign, who commanded a number of soldiers, was called a band, or ancient bearer. Thus it will appear, that a twisted band of hay being tied round a larger quantity of hay, for its support, it is, agreeably to the derivation, properly called a hay-band.

F. bromoides, Linn. Barren fescue. Annual. June, July. Not uncommon.

GENUS—CYNOSURUS, LINN. DOG'S-TAIL-GRASS.

Glumes two, equal, lanceolate, concave, keeled, long pointed, awned, shorter than the spikelet; glumellas two, unequal, the outer lanceolate, keeled, awned at the summit; caryopsis oblong, loose.

C. cristatus, Linn. Crested dog's-tail-grass. Perennial. Flower, July. Not uncommon. According to *Mr. Sinclair's* experience, this grass is inferior, for the purpose of hay, but admirably adapted for permanent pastures. The roots penetrate a great way underground, from which circumstance it remains green after most other grasses are burnt by a continuance of dry weather. In irrigated meadows it arrives at a greater size than in any other situation. *Mr. Cobbet* recommends the straw of this grass for making straw-plat—for bonnets, hats, &c.

GENUS—BROMUS, LINN. BROOM-GRASS.

Glumes two, unequal, lanceolate, acute, compressed, equal to or shorter than the lowermost floret, awnless; glumellas two, unequal, the outer elliptical, cleft, awned near the summit; caryopsis elliptical, depressed, hairy at the summit, united to the inner glumellas.

B. secalinus, Linn. Smooth-rye broom-grass. Annual. Flower, July, August.

B. commutatus, Schrad. Tumid broom-grass. Annual. Flower, June, July. Common.

B. mollis, Linn. Soft broom-grass; goose-grass. Biennial. Flower, June, July. Common. A coarse grass, little relished by cattle. *Mr. Loudon* states, that the grains of this plant bring on giddiness in the human species and quadrupeds, and are fatal to poultry.

B. stirilis, Linn. Barren broom-grass. Annual. Flower, June, July. Not uncommon. *None of these grasses are of any value to the farmer; they are considered weeds.*

Genus—AVENA, Linn. Oat.

Glumes two, unequal, broadly lanceolate, thin, awnless; glumellas two, unequal, outer nearly cylindrical, pointed, deeply cleft, with a long twisted awn from the middle; caryopsis elliptical, united to the outer hardened glumella.

A. fatua, Linn. Wild oat. Annual. Flower, June, July. Not common. A troublesome weed.

"a detested weed
That wildly grows in them, but yields a crop,
As if it had been sow'd."

The awn of this plant is so delicate an hygrometer, and so exceedingly sensible to changes in the moisture of the atmosphere, that it is kept by ordinary vicissitudes in constant motion. *Sir James Smith* states, that the flowers serve rustic fishermen, instead of artificial flies, to catch trout.

A. strigosa, Schrab. Bristled-pointed oat. Annual. Flower, June, July. Common.

A. flavescens, Linn. Yellow oat-grass. Perennial. Flower, July. Muck-heaps, in corn-fields belonging to Mr. E. Bullmore, Mr. J. Selley, Mr. J. Jago, &c. According to *Mr. Cobbett*, the straw* of this grass affords the finest plat of any for making bonnets.

Genus—PHRAGMITES, Trin. Reed.

Glumes two, unequal, membranaceous, shorter than the floret, which are enveloped in long hairs from the stalk; glumellas two, membranaceous, outer with a subulute awnless point; caryopsis oblong, loose, covered by the glumellas.

P. communis, Tin. Common reed; bog-reed; bennels. Perennial. Flower, July. Plentiful. It is used for various purposes, and especially for thatching. On the banks of the Thames it is

*It is a notorious fact, that many years ago wretches sold themselves to give any evidence, upon oath, that might be required; and some of these openly walked Westminster Hall, with a *straw* in their shoes, to signify that they wanted employment as witnesses. From this custom originated the saying, *he is a man of straw*.

encouraged to cover the embankments, as the running roots add strength to the river walls, and prevent the wasting action of the water. *Mr. Hardy* says, the reason why reeds are called bennels is because they were used in making "Bennils, viz., layers of reeds bound together and extended below the roof in cottages not provided with a ceiling."

Flowers spiked; arranged on a common stalk, having alternate lateral excavations.

GENUS—BRACHYPODIUM, BEAUV. BROOME-WHEAT.

Spikelets solitary, nearly sessile, transverse to the rachis, cylindrical, many-flowered; glumes two, opposite, unequal, inner glumella strongly ciliated.

B. sylvaticum, Smith. Slender broome-wheat. Perennial. Flower, July. Not uncommon. Of no use to the farmer.

GENUS—LOLIUM, LINN. DARNEL; RYE-GRASS.

Glumes one or two, the one next the rachis small; glumellas two, outer one awnless or awned.

L. temulentum, Linn. Bearded darnel; "Drunken wheat," of the French. Annual. Flower, July. Mr. E. Bullmore's corn-field. Rare. *Dr. Haller*, affirms that this species, not only produces intoxication, but that, if baked into bread or fermented in ale, its administration is attended by very disagreeable and even fatal effects. It produces headache, giddiness, langour, ringing in the ears, confusion of sight,* (and even blindness for hours,) dilated pupils, delirium, heaviness, somnolency, trembling, convulsions, and paralysis. *M. Burghard* and *M. Schober* mention death as having resulted from its use. According to *Seegar*, one of the most certain signs of poisoning by this plant is the

* "Et careant lolus oculos vitiantibus agri
Nec sterilis culto surget avena solo."
Ovid Fasti. lib.

This quality gave rise to the old proverb, "*he feeds on darnel*," which was applied to a short-sighted improvident person; and thus, in *Plautus*, when *Palæstro* inquires what *Sceledrus* meant by his living on darnel, he receives for answer, "*Quia lusciosus es;*" because you are purblind.

trembling of the whole body. In the year 1853 thirty persons were poisoned by eating darnel flour in their whole-meal-bread, at Roscrea, in Ireland. Some years ago almost the whole of the inmates of Sheffield workhouse were attacked with symptoms supposed to be produced by their oatmeal having being adulterated with darnel. The medical and physical journals record several cases of poisoning by this plant—giddiness, pain, and swelling of the limbs, succeeded by abscess and gangrene were the most prominent symptoms. One of the sufferers lost both his legs. *Dr. Withering* states, that horses, geese, &c., are killed by eating it. By the Chinese laws, this plant is forbidden to be used in fermented liquors—and it has been condemned as a poisonous plant, for more than 2000 years.

L. perenne, Linn. Common rye-grass; red darnel. Perennial. Flower, June, July. Not uncommon. This species is one of the most valuable of our pasture grasses; generally sown with clovers and the chief grass which enters into the composition of hay.

The Society of Arts, in 1805, presented a gold medal to Mr. W. Corston, of Ludgate-hill, London, for a substitute, of his invention, for Leghorn plat. It was formed of the straw of this grass, and was so good, that some specimens had been examined by London tradesmen, who confessed their inability to discover the difference between them and the real Italian Leghorn.

L. perenne, Var.: *multiflorum*, Lam. Bearded rye-grass. Perennial. Biennial, or annual. Flower, June, July. Corn-fields. Scarce.

Genus—HORDEUM, Linn. Barley.

Glumes in three parallel pairs, opposite to the excavation, each pair containing one floret.

H. murinum, Linn. Wall-barley; way-bennet; squirrel-grass. Annual. Flower, June,—August. Waste-ground, Selley's farms, &c. Plentiful. This grass injures the hay, and lessens the value of the crops. Its strong beards or awns hurts the mouths of the horses so much, that in the Isle of Thanet, where it is very common, it is said to be one of the greatest recommendations of an inn to have hay without squirrel-tails or bearded-grass. Hist. Kent. Children amuse themselves by inserting a spike between the wrist and the sleeve of the jacket. The arm is now swung back and forwards for some time, when, on stripping, they perceive, with wonder, that the grass has crept up, perhaps to the arm-pits.

GENUS—TRITICUM, LINN. WHEAT.

Glumes two, at each joint of the rachis, oblong, opposite to each other; glumellas two, lanceolate, outer one acuminate or awned at the summit, inner bifid at the point; caryopsis free.

T. junceum, Linn. Sea-wheat-grass. Perennial. Flower, July. Rare. Swanpool. H. Bastian, 1856. This plant is admirably adapted for fixing loose sands.

T. repens, Linn. Creeping wheat-grass; couch-grass; quicken. Perennial. Flower, June, July. Common. This grass in England is regarded as a troublesome weed. In Italy and the south of France the *underground* shoots are collected by the poor people, and sold as food for horses. *Sir H. Davy* found them to contain nearly three times as much nutritious matter as the stalks and leaves; and it has been stated on the authority of a French veterinary surgeon, that *exhausted and worn-out horses are very speedily restored to strength and condition*, by giving them, daily, one or two bundles of couch-grass, of ten or twelve pounds weight each, mixed with carrots. Cattle of all kinds are fond of these sweet and wholesome underground shoots. Dogs eat the aves of this grass to excite vomiting.

Contributions to the Fauna of Falmouth.

BY W. P. COCKS.

THE EARWIG.

" The well ordained
Laws of Jehovah."

" The wonderful all-prevalent analogy that
testifieth one Creator.
The broad arrow of the *Great King* carved
on all the stores of his arsenal."

Martin Tupper.

The Earwig—a name given it from a notion that the insect frequently introduces itself in the ear, causing great pain, and even death. (For this imaginary evil, *Pliny* says, the juice of green hemp-seed being dropped into the ears, driveth out any worms or vermin therein engendered; yea, and what *earwigs* or such like creatures that are gotten therein.) The creature is harmless to all things but fruit, flowers, and vegetables in their season. The earwig is very common, and appears to prefer damp and shaded situations, and during the day it is found under stones, logs of wood, bark of trees, &c., only leaving its retreat at night in search of food. The female earwig hatches her eggs with the maternal assiduity of the hen. *M. D. Geer* found under a stone, in the month of June, a female with many young ones, which appeared to be just hatched. They kept close to her, and often crawled under her belly, as chickens do under a hen, and in this position, she allowed them to remain for hours together. At another time, about the beginning of April, he discovered a female under some stones, sitting on a number of eggs, of which she took great care. In order to study her proceedings, he placed them in a box, half filled with earth, and scattered them on the surface, but she soon carried them in her jaws one after another into one place, and remained on them without quitting them for a moment. The brood appeared in about five or six weeks. He fed them with *bits of ripe apples*, upon which they thrived, casting their skin, several times, like caterpillars.

J. Rennie, Esq., has published the following interesting notice in the *Penny Magazine* :—

"About the end of March, I found an earwig, brooding over her eggs, in a small cell scooped out in a garden border, and in order to observe her proceedings, I removed the eggs into my study, placing them [upon fresh earth under a bell-grass. The careful mother soon scooped out a fresh cell, and collected the scattered eggs with great care to the little nest, placing herself over them, not so much, as it afterwards appeared, to keep them warm, as to prevent the too rapid evaporation of their moisture. When the earth began to dry up, she dug the cell gradually deeper, till at length she got almost out of view; and whenever the interior became too dry, she withdrew her eggs from the cell altogether, and placed them round the rim of the glass, where some of the evaporated moisture had condensed; upon observing this, I dropped some water into the abandoned cell, and the mother soon afterwards replaced her eggs there. When the water, which had been dropped, had nearly evaporated, I moistened the outside of the earth opposite the bottom of the cell, and the mother perceiving this, actually dug a gallery right through to the spot where she found the best supply of moisture. Having neglected to moisten the earth for some days, it again became dry, and there was none, even round the rim of the glass, as before. Under these circumstances, the mother earwig found a little remaining moisture quite under the clod of earth, upon the board of the mantel-piece, and thither she forthwith carried her eggs. The subsequent proceedings were not less interesting; for though I carefully moistened the earth every day, she regularly changed the situation of the eggs morning and evening, placing them in the original cell at night, and on the board under the clod, during the day, as if she understood the evaporation to be so great when the sun was up, that her eggs might be left too dry before night. I regret to add, that during my absence, the glass had been removed, and the mother escaped, having carried away all her eggs but one or two, which soon shrivelled up."

The young ones differ very little from the perfect insect, except in wanting elytra and wings.

The earwig employs the caudal appendages as forceps and instruments both of offence and defence; but according to *M. Barbut*, the forceps is not so formidable as it at first appears, being destitute of strength sufficient to produce the least sensible impression. August 19, 1755, there were such quantities of earwigs in the vicinity of Stroud, that they destroyed not only the flowers and fruits, but the cabbages, were they ever so large. The houses, especially the old wooden buildings, were swarming with them. The cracks and crevices were suprisingly full, they dropped out in such multitudes, that the floors were covered, the linen, of which they are very fond, were likewise full, as well also the furniture, and it was with caution that people ate their provisions, for the cupboards and safes were plentifully stocked with the disagreeable intruders.—*Gentleman's Magazine.*

The best method of destroying them is by catching them, which is effected by hollow tubes (dried reed, hollow stem of sun-flower, Jerusalem artichoke, or cow-parsnip,) which are to be laid here and there in orchards, kitchen-gardens, flower-beds, &c. They are easily entrapped between folds of paper, cloth or linen; garden-pots, with a little moss within and inverted on sticks, are employed for the same purpose, as well as the claws of lobsters or crabs. It is useless to guard the stems of plants, as *earwigs are winged insects.*

CLASS—INSECTA. ORDER—ORTHOPTERA.
FAMILY—FORFICULARIÆ, LAMARCK.

Anterior wings coriaceous, very small, uniting in a straight suture, horizontal, partially covering the wings; posterior wings large, transparent, with transverse and longitudinal folds; mouth with transversely moveable jaws, the posterior pair being sheathed; legs of equal size, remote, nearly equidistant, and simple, formed for running; tarsi three-jointed.

GENUS—FORFICULA, LINN.

Head moderate, flat, somewhat triangular; eyes small, lateral; antennæ long; filiform, consisting of from twelve to fourteen joints, inserted before the eyes; palpi filiform; labium with two deep divisions; body long, linear, compressed; thorax truncated, anteriorly; wings plaited like a fan, and folded transversely under two very short wing-cases; abdomen composed of nine segments in the male, seven in the female, terminated by two horny appendages, curved, pointed at the apex; toothed at the inner side at the base in the male, nearly straight and crenulated within in the female; tarsi with three joints, second one bifid.

F. auricula, Linn. Length, eight to ten lines. Colour, light-reddish-brown. Forceps, in the male, semi-circularly curved and toothed at base, nearly straight and crenulated in the female. Common.

F. borealis, Leach. Length, eight to nine lines. Somewhat darker in colour than the *F. auricula*, with a patch of black at the base of each segment of the abdomen. Forceps, in the male, elongated, slightly curved, base orange red; apex blackish; toothed nearly straight in the female. Trefusis and College Woods, and the heights at Pendennis and Pennance.

GENUS—LABIA, LEACH.

Antennæ short, stout, ten to twelve joints; palpi short, filiform, terminal one truncate, pubescent; body pubescent; caudal appendages, slightly incurved and armed with minute denticulations; within in the male; straight, and simple in the female; tarsi, with intermediate joint, simple.

L. minor, Leach. Length nearly five lines. Garden, Harriet Place, Tehidy Terrace Lane, &c. Not uncommon in the summer season and beginning of autumn.

CLASS—INSECTA. ORDER—DIPTRA.
FAMILY—MUSCIDÆ, WESTWOOD.

Antennæ composed of two or three joints, generally three, the last compressed with a simple or plumose seta on its back near the base; proboscis membranous, bilobiate, sheathed, retracted into the buccal cavity in repose, and inclosing in a groove above a sucker of two setæ.

GENUS—PIOPHILA, FALLEN.

Face not prominent; mediastinal, nervoure double; body shining; palpi clavate; abdomen oblong, depressed, third joint of antennæ oval; style naked.

P. casei, Fal; Tyrophaga Casei, Curtis; Musca Casei, Linn. Cheese-fly. Length one and a quarter line. Common.

The Cheese-fly.—This tiny creature is the parent of the cheese-hopper, and does great mischief to fresh cheese, by inserting its ovipositer into the cracks and depositing its eggs—upwards of 250 in number.

Swammerdam (Dr. John, one of the greatest zootomist of his time), says, 'I have seen them myself thrust out their tails (ovipositors) for this purpose to an amazing length, and by that method bury the eggs in the deepest cavities. I found in a few days afterwards a number of maggots, (larvæ) which had sprung from those eggs, perfectly *resembling those of the first brood that had produced the mother fly*. Describing of the grub or cheese-hopper, he says, I have seen one, whose length did not exceed the fourth of an inch, leap out of a box six inches deep, that is twenty-four times the length of its own body.* Which is as if a man six feet should rise himself in the air by jumping 144 feet!

* Old and dry cheeses are damaged, and if neglected, entirely destroyed by the colonies of mites produced by (one female mite) the *acarus siro, Linn.*

On the Cornish Language.

BY JOHN BELLOWS.

The specimen of a Chapter of Genesis in the Cornish language, which accompanies this, is taken from a work published in 1827, entitled "The Creation of the World," and edited by the well-known antiquarian, Davies Gilbert. He intended by this publication, to create an interest in the dialect of which he had been at the pains to collect some fragments, hoping thereby to lead to further efforts for its preservation.

It must be regretted that no Cornishman has thoroughly followed up the work he began; for whilst there is no lack of scholars who study the *Welsh*, this, its sister dialect has, well nigh passed into oblivion.

It may, perhaps, be said, that as Cornish is no longer *spoken*, and contains no literature worth mention, there is not sufficient inducement to learn it. This is true, so far as regards its use as a medium of communication. But there is another aspect in which a language may have claims on our attention, besides this, viz:—the aid it is capable of affording, in tracing the roots of words in other tongues—the light it may cast on the relationship of some of those tongues to each other. Even a dead language will thus furnish us, at times, with links in a chain that must otherwise remain imperfect. In this, then, lies the present value of Cornish to us; and if the language is suffered to disappear entirely, the science of philology will sustain some loss by its doing so.

The lapse of each generation must render it more difficult to collect the fragments that have never been embodied in writing; for as the peculiarities of the existing dialect disappear, we lose with some of them, a key to the meaning and pronunciation of old words that yet linger on among the common people. It would have been easier to construct a vocabulary of Cornish a century ago, than such a task would be now; and even now the difficulty would not be so great as will be the case if the attempt is deferred till that polished time in which our miners will have ceased to use such words as "*clunk*" or "*skat*;" or "*pure*" instead of *very*.

All I propose in this little sketch, is to point out some relationships between roots in the Cornish, and those of some other languages; but before doing so, it may not be amiss to glance at the difference between the older and the more recent modes of accounting for such relationships.

For a long period it was taken for granted by scholars that Hebrew was peculiarly the language of divine institution; at once the oldest and the most profound treasury of human speech. Therefore, in tracing words to their earliest forms, it was but natural to search the Hebrew for them, as the fountain from which all other languages had flowed at some time or other. Certain resemblances between that tongue and the Welsh, amongst others, were held to confirm this theory—but a few zealous Celts reversing this order of procedure, came to an opposite conclusion, maintaining theirs to have been the primeval speech, and hinting that it must have been spoken in Paradise, before Hebrew was thought of.

There were other resemblances, however, besides those with Hebrew; and Milton, perhaps from an idea of some of these, says the ancient Britons spoke "a kind of Greek." The writer of the article "Grammar," in the London Encyclopædia, points out a number of words in the barbarous languages of Northern and Western Europe, as so evidently allied to Greek and Latin, that he argues with much ingenuity for the theory of a classic origin of both Celtic and Teutonic dialects, endeavouring to prove them simple corruptions of the more noble written forms, and ridiculing their pretensions to antiquity.

These surmises have been set aside by the discovery of the common Asiatic origin of what are termed the Indo-European or Aryan languages; and by the classification of most languages into three distinct families—viz: Semitic, Aryan, and Turanian;* the first comprising Hebrew, Arabic, &c., &c.; the second, most of the present European tongues, as well as the Zend or old Persian, and the Sanskrit, the parent of many of the Indian dialects. The Turanian family includes the Tartar and Finnic languages, &c.

One of the oldest classes in the Aryan family is the *Celtic*, differing greatly from the others in its grammatical formation, but clearly shewing its Asiatic origin. It is divided into Gaelic, a dialect of Ireland and the Highlands of Scotland; Manx; Cymeric, which includes Welsh and Cornish; and Armoric or Breton, still spoken by some three-quarters of a million of people in the north-west of France.

The Scandinavian and Germanic tribes passed into Europe, it is believed, considerably later than the Celts. The several dialects they speak are closely related to each other; and, whilst their grammar is very different from the Celtic, many of their root words are the same as are found in the latter. Dr. Ogilvie, whose opinion should have weight on such a subject, says, "The vernacular words in the Celtic and Teutonic languages of modern Europe, which are evidently the *same words* as still exist in the Shemitic languages, are of the same antiquity."

These resemblances in the roots go strongly to prove a common origin—as there is but one other mode of accounting for them; *i.e.* by supposing such words to have passed from one nation to another during after intercourse

Here a difficulty arises: how are we to distinguish between these imported words, and those which properly belong to a language? In the case of Cornish, for instance, may not certain resemblances to Latin be traced to Roman influence, whether of soldiers or priests, in their communications with that part of Britain? And again, may not what seems to be a Teutonic element in this dialect, owe its presence to the encroachments of the Anglo-Saxon, before its final triumph left the Cornish a "dead language?"

* See Max Müller's Lectures.

That much allowance must be made on these grounds, especially the latter, there cannot be a doubt; but this will not apply with equal force to *every part* of the language. There are two classes of words to be considered: the one representing what may be called compound ideas, and the other, simple ones. The first embraces such abstract terms as are seldom used; and these are more easily forgotten and more readily supplanted than those which constantly occur. Thus, an Englishman may borrow from Latin or Greek such terms as *Tribulation*, *Metaphysics*, *Polytechnic*, and the like; but he will not give up the use of such words as *house*, *land*, *sea*, *day*, *night*, and a thousand others which are constantly on his lips, even after any amount of foreign intercourse, or literary culture. The frequency with which they are uttered is their safeguard; and whilst many imported words slowly change their meaning, most of the short Saxon sounds keep true to the sense in which they were first used.

Let us take a simple verb—"*to make*," or "*to do*." This is *gwra** in Cornish. If it exists in Saxon, it is only in an imperfect form; perhaps in the prefix *ge?* and it may be in the word that stands opposite the English, in the following list. It is clear, then, that wherever the Cornish received it, it was not through the Anglo-Saxon. Yet it is found in the Scandinavian languages plainly enough, as

Icelandic and Swedish,	*gora*, to make or to do.
Lowland Scotch (a Teutonic dialect),	*gar*, ,, ,,
English (in a restricted sense),	*char*, to work.
Sanskrit,	*kar-tum*, to make or to do.
Persian,	*kar-dan*, ,, ,,

The Latin has also *gero*, to carry, or *to do*.

It should be remembered that the *w* in Cornish is equivalent to long *oo*; and that the *g* in the Swedish word is rather softer than in English. That it was so pronounced in the Cornish we may infer from its occasional omission, as for instance, in verse 1 of the specimen, "'wraz." This frequently happens to words

* See specimen.

beginning with g, as *gwellas*, saw, (verse 4), which is elsewhere spelled "*wellas.*" (Welsh, *welais*). *Gwithian*, a tree, in like manner becomes *withian; gwir*, true, (Welsh, *gwir*), becomes *wir*, and so on.

We may notice also the practice of the country people of Cornwall at the present day, in confirmation of the use of a softened *g*, which they pronounce as *y*, in "*Anyel,*" "*Inyan,*" "*danyer,*" instead of *Angel, engine, danger*, &c., &c.

It is difficult to express guttural sounds with precision, by written characters; and it would seem that these characters vary with almost every nation. C, ch, g, gh, h, k, ll, are each used for this purpose; and the gradual departure of some of them from their true sounds may have increased the discrepancy between words originally the same. The Cornish "*Kern*" is a good example of this.

To begin with the Semitic family of tongues, the word *K r n* (Keren or Karan), means *a horn*, in Hebrew, Chaldee, Arabic, Syriac, and Ethiopic. It also means *to shoot forth light: to shine*. And the reader will see that the primary sense is a *projection* by comparing the following:—

In the Aryan languages we have

Latin,	*cornu*,	a horn.	
Greek,	*keras*,	,,	(also a peak; a promontory;
Welsh,	*corn*,	,,	a wing of an army).
Cornish,	*corn* or *kern*,	,,	
Breton,	*gorn*,	,,	

The guttural sound beginning this word is represented by the aspirate in the northern tongues—as in each of them the word is spelled *horn* (Icelandic, Norsk and Swedish, German, Anglo-Saxon, and English the same). It occurs in the sense of mountain, or peak, in Switzerland, as *Wetter-horn, Aar-horn*. *Carn*, in Cornish, is a heap of stones, (Scotch, *cairn*, Welsh, *carnedd.)* *Carn* in Welsh is *a handle;* also, *prominent*, as *carn leidr*, an arrant thief; *carn fradwr*, a noted taitor. In Welsh *cornel*, Gaelic *cearna*, is a corner; and this in Swedish is *horn*, Norsk *Hjorna* nounced *yorna).* In the northern languages it meant also *promontory* (as *keras* in Greek). This sense is probably the clue to the old name of Cornwall: "*Kernow*" the *Promontories.*

Another derivation may be traced pretty clearly from this root. The horn is admitted to be an appropriate emblem of power, and as such it appears to have been worn by the chieftains of tribes at an early period; and allusions to its use are very frequent in the Bible, as well as on ancient monuments. An Egyptian sculpture shews one of the Pharaohs bearing widely branching horns of lordship; and the conqueror Cyrus is figured on a pillar near Persepolis, with eagle's wings, and his forehead surmounted by ram's horns denoting his kingly power.

This of course was symbolical. It could only be in the rudest condition of society that real horns were worn. They were replaced by a circlet of gold or silver adorned with smaller ornamental projections, which formed a more elegant distinction; but in the name of this badge we see the root of its humble predecessor:—Latin *corona*, Welsh *goron*, northern languages *Krone*, a crown.

If any doubt could arise, then, as to *kern* or *corn*, being a proper Celtic word, or merely an adopted one from the Romans or Saxons, it may be set at rest by noticing—

1st.—The presence of it in *several* Celtic dialects; for it is difficult to see how it could have passed from one to another, say from the *Welsh* to the *Breton* for example, even if the former had received it from an extraneous source.

2nd.—The presence of *other* derivatives from the same root in several of these dialects; for the Welsh *cornel* and Gaelic *cearna* would scarcely be taken from the horn of an animal, but rather from the radical sense of something *projecting* or *thrown out.* The same may be said of the Welsh for *a handle*, and the Cornish for *a heap of stones.* See also in Greek *keraunos*, a thunderbolt, *kerkos*, the tail of an animal, and *kerkis** a shuttle, to each of which, as well as to *keras*, the idea of *projection* or *throwing out* is attached.

(* *Yerk* is probably allied to this.)

The root must be very ancient to be represented thus closely in two distinct families of speech, for it must have been in use prior to their separation; or it could never have impressed itself on so many of their branches. It must have been, moreover, very sharp and well defined in its acceptation, or it could not have remained so near its original meaning after thousands of years, and among distant nations.

Let us next take two of the Cornish words for *the earth* and *the world*—*teer* and *beys*. They are variously spelled; as are also most other words in the volume from which I copy them; for the sound only has been aimed at by the writers, without regard to rule, and they have indulged in some strange freaks whilst doing so.

Teer, *tir*, or *tîr*, is the dry land (verses 9 and 10), and the following list may help us to trace this to its root. (The reader will notice the relation between the terms for *dry* and those for *thirst*, which will be referred to presently.)

Cornish,	*terhi*,	to dry			
Gaelic,	*tiorma*,	,,	*tart*,	thirst	(pronounced nearly [as *tarsht*.
Greek,	*terso*,	,,			
Latin,	*torreo*,	,,			
Swedish,	*torra*,	,,	*Törst*,	,,	(pronounced *terst*.)
Norsk,	*törre*,	,,	*Törst*,	,,	
German,	*dürre*,	dryness	*Dürst*	,,	
A. Saxon,	*dri*,	dry	*thurst*,	,,	
English,	*dry*,		*thirst*.		

A comparison of these with some of the equivalents for *land* or the *earth*, will, I think, shew the latter to have originated in the distinction of "*the dry*" as contrasted with the water, or sea.

Gaelic	*tir*	land.	
Cornish	*tir*	,,	the earth.
Welsh	*tir*	,,	*daear*, the earth.
Latin	*terra*	,,	the earth.
Sanskrit	*dhara**	the earth.	

* Dhara is said to come from *da*, to give; and this on such high authority that I hesitated as to placing it with the above. But as one or two difficulties seem to me to be in the way of this derivation, I may be excused for stating them; which I will do as briefly as possible. In the first place, "*the Giver*," although not an unsuitable name, as applied to the earth, could scarcely have obtained in a rude

I believe the northern languages have not this word in the sense of the earth; but they have something near it in the name of the *dried* sods used for fuel: Norsk, *Tö r*. Swedish and German *Torf;* Saxon *tyrf;* English *turf.* The Norsk word has not the extended meaning ours has—for it applies *only* to *peat,* such as can be dried for burning. Lastly, the English provincialism *tore,* used for withered bits of grass left on a field when the mowing season is over, points clearly to the same source.

Zeah is another Cornish term for dry (see specimen, verses 9 and 10). From it they had *Zahas* thirsty; and it is doubtless, allied to the Greek *Xeros,* dry or withered; *seir,* the sun; *seiro,*

and primitive state of society. It originates too much in a process of reasoning; and not sufficiently in an inductive one. The word most likely to come into general use as the *name* of a thing is that which suggests its *most striking* characteristic. Thus, if we were to call *night* "the *cold,*" there are some circumstances in which it would be a suitable designation; and "the *still*" might be suggested as equally good; or many others. But if we speak of it as "the *dark,*" we recall an idea that is inseparable from it; whereas the cold may mean winter, and the still may refer to a pond. So in describing earth as the Giver, we make an allusion perfectly clear to the tiller of the soil; but not to the hunter, the herdsman, or the fisherman, to each of whom it would suggest a different idea. With the term "the Dry," it is very different. Every man would *instinctively* think of the *land,* the moment he heard it; and, therefore, it is the most fitting designation for land.

In the second place, as the resemblance between the Sanskrit word and the Latin cannot be accidental, they must be simply two forms of the *same* word. As I have shown a *prima faciæ* reason for believing *terra* to be the purer of these forms because coming from a root *tor* or *tr,* signifying dry, grant for a moment this may be the case. It would then follow that *dhara* is corrupted from this root, of the existence of which, in the primitive Aryan speech we have decisive evidence; for had it not been there, we should not have *terhi* in Cornish, meaning the same as *torra* in Swedish, and *torreo* in Latin.

It next remains to be seen whether this *tor* or *tr,* has passed into the Sanskrit (with the meaning of *dry* attached to it,) as well as into the European languages. Perhaps a simple mode by which this may be tested, is by tracing out a *natural idiom.* Some idioms are of fanciful origin, and are only current within a small compass, or among a certain class; such as that of the Cornish miners who call a *rest,* in the hours of labour, a "*touch-pipe,*" whether it is occupied in smoking or not. Other figurative expressions are *national,* arising from circumstances not affecting the word at large—and others again are founded on an *instinctive* perception of the relationship certain objects, or sensations, bear to each other. Thus, it is common to many languages to have a word for life, or soul, taken from one denoting *breath*; because of the inseparable connection between animal life and this manifestation of it. This I call for want of a better term, a *natural idiom;* and precisely such a one is that of expressing by nearly the same word, the *dryness* of the ground, and the *sensation of thirst.* We see in a preceding table of words, how regularly the Teutonic nations have done this; and that even our own terms, different as they are now, were once closely connected. We see to dry up. (Anglo-Saxon *sear*, withered.) Whilst the Cornish in this instance, resembles the Greek so closely, the Welsh equivalent approaches the Latin *siccus*, dry, (or thirsty.)

Breton and Welsh *sych*, dry. Welsh *syched*, thirst.
Hebrew and Chaldee *tsach*, ,, Hebrew *tsachuana*, thirst.

Beys, or *bes*, the world, (verse 22) is from *bew* to live (pronounced be-o.) The root is a very old one; and the perfect state in which it occurs (with many derivatives) in Cornish, goes far to shew the antiquity of the language. The Cornish must have been detached from the Aryan stock, before this word had lost any of its original meaning; but whether as much may be said of the Teutonic languages, is doubtful.

What that original meaning was we can see from a few examples. The ancient Egyptians, according to Horapollo called life, or soul, *bae;* and from this root they named the hawk or falcon *baieth*. It was a recognition of the vital energy so fully manifested in the brilliant eye and rapid flight of this bird, which seems to have suggested this.

Compare this *bae* with the Cornish *bew*, to live; *bees*, life.
Welsh *byw*, ,, *bywyd*, ,,
Gaelic *beo*, ,, *beat-ha*, ,,
Greek *bioō*, ,, *bios*, ,,

Our English "being" existing, is from the same root, as well as
Cornish *best*, a living creature.
Welsh *bwystfil*, ,,
Gaelic *beathach*, ,, (pronounced [*beast-ach*.
Latin *bestia*, ,,
Northern tongues *beest* ,,

further, the same idiom in the Celtic and the Latin; and that it also extends to the Semitic family, as in the Hebrew *tsach*, and *tsachuana*. Now, Sharon Turner gives *torscho* as the Sanskrit for "to thirst;" and if this is correct, it is plainly the same as the Gaelic *tarscht* (spelled *tart)* and Swedish *törst*. As these are clearly from *tor* or *tr* dry, it would follow that *torscho* came from the same root, whether it *now* exists *separately* in Sanskrit or not. May not *dhara* have been corrupted from this root, before the *written* period of the language?

[Since the foregoing was penned, I have ascertained through the kindness of Professor Williams, of Oxford, that *tarsha* is the correct form, written in Bengal as *torsho*; that it comes from *trish* "to be thirsty;" but that trish does not mean "to dry;" the latter being represented by a word resembling the Latin *siccus*. Professor W. adds, however, that our word dry seems to be connected with *trish*.]

Although it has been supposed that *beast* comes from the sense of *wildness* or *ferocity*, it will be seen that such meaning is accidental and *not* radical. It is as fitly used for a lamb as for a wolf; for an ox as for a bear. It may very possibly, in process of time, come to mean only *wild* beast; but it is not possible that a name which *originated* in the idea of *wildness* could *afterwards* be applied to tame and wild animals indiscriminately. We can trace a *lowering* of this very word, since the time of the translation of the Bible for instance—for it was then used much more nearly in the sense of *animal*, than at present. "The serpent was more subtil than any *beast* of the field." After Paul's shipwreck, we read of the viper that fastened on his hand, that he "shook off the *beast* into the fire." And in Revelation IV., the Cherubic beings are described as the "four *beasts*." * We may be sure the translators knew too well the exact value of the term, to have employed it here for *living creature*, if it had *per se* implied anything degrading. If its meaning had been confined to *wild* animal it would have been used in the thirteenth chapter only, but not in the fourth. In the Gaelic Testament the distinction is made between these, by different terms; but mark,—the one chosen for the higher sense in chapter 4, is the very word given in the foregoing list,—"*beathach*." A glance at these texts will enable the reader to perceive the bearing of this.

Words once used in a low or bad sense, rarely, if ever, lose it; but such as arise from a neutral idea, frequently sink to a lower level. Thus in vulgar English, "*animal*" means a rough, coarse, fellow—and "*beast*" a dirty one.

The next derivation from this root goes in a different direction. By the same natural idiom that leads us to say "I *live* in London," instead of "I *dwell*" there, this *be* to live, was also used for "to dwell." This comes out clearly in the Icelandic equivalent for the latter, *bua* (pron. bee-a). From this again the Norsk and Swedish have "*By*" a town (pron. *bee*,) a common termination to names of places in Scandinavia, as Vesterby, Nyby, &c., as

* Wesley says, pithily, (in reference to the present acceptation of the word here) "not beasts any more than birds."

well as in those parts of England peopled by the *Norsemen*, as Hornby, Ashby, &c., &c. The Saxons did not use it in this sense, for there is not a single instance of it on the map, south of the "Watling-street," which was the boundary between them and the Danes, Tenby only excepted. They did use it, nevertheless, for *dwelling;* and this was continued in English down to the time of Charles II. at least, for Bunyan has it in his writings. And in an old volume before me of the same period, I read that a good man who was released from an unjust confinement says:—"I preferred going unto my own *being*."

The link which connects "to dwell" with "to live," is that *permanent continuance* which is implied in the idea of life. Where *this* is not present that link is broken, and we cannot use the phrase. We do not say "I am *living* at Fowler's Hotel," but "I *stay*;" or "I *stop*" there. The root *be* has been retained in this midway sense in the Norsk, without alteration in sound. *Bie* is to *continue* in a certain state; to wait; and the Saxon *bid*, English abide, are from this.

Bua [bee-a] to dwell becomes *bo* in the Norsk and Swedish; and *Bo*, a house, from this. In like manner we have in Cornish *bo*,* a house; as "*Boskenny*," house on the hill; and in English, "*boor*," a dweller, or occupant of the soil; "*neighbour*," near-dweller, &c., &c.

In accordance with a frequent change in Cornish, from *b* to *v*, we find *bew*, *bex*, *best*, also spelled *vew*, *vex*, *veest*, &c. This, though familiar to many persons, seems rather a startling alteration, to those who have paid no attention to the subject; and I will, therefore, make a remark on it before proceeding to another root. The letter *b* represents a sound made by *first closing* the lips—but if not *perfectly* closed, the slight escape of air between the upper lip and the teeth, produces *v* instead. The latter is in one sense, nothing but an imperfect *b;* and a careless pronunciation would frequently lead to its adoption instead of b, unless physical structure forbad it, as in the case of the negro, who says *berry*

* *Chy* also means a house—as "Chyandour," house by the water.

for *very*, *gib* for *give*, and so on. No one supposes these to be different words, because thus corrupted; and no one ought to find the difficulty greater where the reverse holds good. Look at the freaks this consonantal change has played with the verb *to have* in some of the European languages—*habeo*, *avoir*, *haben*, *haver*, &c., &c. The old Romans wrote, for one of our rivers, "*Sabrina*;" but there is reason to believe that some of them at least, pronounced it *Savreena*; and in this form it approaches pretty near our own name of that stream. The alphabets of a variety of nations recognise the relationship of which I speak, so far as to use the same character for both sounds—or nearly so. In the Russian and modern Greek, *b* is sounded *v*—and this will explain the diversity, in the newspapers, during the late war, in the spelling of Sebastopol; some of them following the written and others the spoken form. The Greeks pronounce Bion, *Veeon*, bios, *vee-os* and so forth. Keeping these facts before us there is no difficulty in accounting for the change of the Cornish *bew* to *veo*; of the Gaelic *beatha* to *veatha*; nor of the *same root* in its passage into Latin, to *vita* (pronounced veeta).

We can readily suppose that after a given root has passed into separate languages, it may furnish names for things but remotely related to each other, or even diametrically opposite. Thus a Celtic word signifying, among other meanings, "to die a violent death," occurs in its Scandinavian form as a synonym for "*safe* or *secure*." How this happens we can best understand by tracing the changes that took place in its application, step by step.

We will begin with the Swedish *trycka*, Norsk *trykke*, to press or squeeze. This gives rise to numerous derivatives, among which are *trykke*, [German *drucken*] to print; *tryk*, a thrust with a sword [English *trick*]; *trykker*, the finger piece of a latch, or of a gun [English trigger]; *trygle*, to beg with importunity; &c.

The action of *pressing* is so often associated with *stopping*, that the same word came to convey the latter idea as well. We press down a cut for instance, to stop the flow of blood; or thrust back an intruder to stop his advance; or push a wedge under a wheel to stay its rolling.

Thus the German has *drucksen*, to tarry; and the English *trickle* (from the same root,) alludes, not to the continuous flow but to the lingering, almost intermittent, motion of a tear down the cheek. With the same idea in view, the Norwegians have *trag* for *slothful*; whilst curiously enough the Swedes, with more regard to the root, have *tragen* for *diligent*, because diligence implies pressing forward to attain an object.

We have the secondary sense quite pure in the English verb, "*to trig*," which is, to stay a thing by pushing a wedge or prop against it,—as to trig up a wheel—or to trig open a door.

But there was a very important use of the same verb, in the experience of the Teutonic tribes, who were well versed in fighting; and that was, to stay hostilities in the midst of battle. We have it in the Gothic *triggwa*, Icelandic *trigd*, a truce; (that is a "stop!") It is somewhat significant that the Italian word is *tregua*. Did the Italians learn this from strangers; and if so, from whom?

From *trigd*, a truce, the Norsk and Swedish have *tryg*, safe or secure. The history of the same word in the Celtic dialects is rather different. It appears to commence at the second of the stages we have just examined, as

Welsh *trig*, a fixed state.
Cornish *trig*, the low water mark (that is the "stop" of the tide.)
Welsh *trigo*, to stay, to carry, TO DWELL; to die a violent death (that is, to be *stopped* suddenly in life, the career of life.)
Cornish *trygva*, to dwell
Welsh *tregias*, a dwelling-place.
Cornish *tregas*, a dwelling-place.

The latter is the word we have in the abridged form *tre*, a *dwelling-place*, or *town*, in modern Welsh, Cornish, and Breton. It is the constantly recurring prefix to names of places in Corn-wall especially; and it also becomes a termination by changing its initial, forming *drea*; as in *Pedn-an-drea*, "head of the town," &c.

Nor is there anything of mere chance in this; for in the regularity with which such changes take place, we may observe the working of one of the laws that govern the progress of language. That is, the substitution of a *definite meaning* for a *general* one. The human mind, ever deals with THINGS, and with things only; for pure abstractions are out of its grasp, no matter how powerful the intellect that strives to realize them. It constantly seeks to *individualize* whatever passes before it; and the effect this has on words is worthy of attention. Its tendency, for example, on a *verb* of wide signification, is to compress it by degrees into a narrow compass; so that it shall only represent *one* action where it might previously have been applicable to ten, of which this one was the most prominent. Thus the verb *to slay* primarily meant *to strike*. It included every sort of striking, whatever the agent, or the object, or the effect produced. From this wide or loose sense, it became restricted to *striking with a weapon*; as in the time of Ethelbert when there was a penalty of twenty shillings for "off-slaying" a man's thumb. It has since drifted into a still narrower sense; so that we only use it now for *such striking with a weapon as produces death.**

The same process goes forward after the verb gives rise to a noun. The word *town* which originally meant *an inclosure*, (as in the provincialism "town-place," for a farm yard) became the synonym, among the Saxons, for one principal enclosure—a *city*; and we have taken it a step further in applying it pre-eminently to *one city*, London.

Grammatical structure only affects this progression so far as to determine the *mode* in which it shall be accomplished, but in this mode consists the distinguishing feature of each language. Grammar has nothing to do, for instance, with the question of whether the Cornish people should derive their word for "*fire*," from an Aryan root signifying "*to burn*;†" but it decides, *if* such a word

* In Norway, where language changes very slowly, the word is still used in its original sense, as in "*klokken slaaer*," the clock strikes, &c., &c.

† Sanskrit *dah* to burn; Gothic *dahan*; Cornish, Welsh, Breton, *tan*, *fire*: Norsk and Swedish, *tände*, to kindle: English *tinder* material for kindling, &c.

is derived, what form it shall take—what alteration it shall undergo not only to make from it noun or verb, but to distinguish number or case in the noun, and person, mood, or tense in the verb, &c., &c.

Keeping these points in view, we must see that the etymologist has other aids to the investigation of a language, than those of resemblances in sound; which, taken by themselves, may prove very deceptive. In the case of the ancient Cornish, I suppose an examination of the grammar, and a careful comparison of idiom, would be of essential service; whilst at the same time the present spoken dialect of Cornwall should not be overlooked. This is of course, in the main a Saxon dialect; but it is not the Saxon of Gloucestershire, or of Dorsetshire, by any means; since, unlike each of these, it has had a considerable tinge of Celtic infused into it. The reason is plain. In the counties just named, Saxon was the native tongue of the inhabitants, or pretty much so; but in Cornwall it was a foreign language. By and bye when the Armoric shall have disappeared from Brittany, the tongue that takes its place will be called French; but it will not be such French as they speak in Paris, we may be sure, any more than that is so which now obtains in Normandy.

The peculiarities in the present Cornish which most readily strike a stranger, are, firstly, the frequency with which the accent is placed on the *second* syllable in the names of persons or places:—as *Trevithick*, *Polglase*, *Portreath*, *Redruth*. This is opposed to the practice of the Teutonic nations, who pretty regularly accent the *first* syllable, as the Saxons did. Look at the names, Egbert, Ethelbert, &c.; or at those places in Cornwall which bear Saxon, and not Celtic, designations; as *Falmouth*, *Camborne*, *Padstow*. This difference is the necessary result of the relative position of the adjective in Saxon and Cornish; for whilst in the former it is placed before the noun, in the latter it usually comes after it. Why the accent should be governed by this is evident. The adjective is *the distinctive* part of the word in a compound; and therefore, we give greater emphasis to that part to direct attention to it. Notice the difference in this emphasis in "*flower*-garden" and "*garden*-flower;" or in the names *Penzance*, and *Holyhead*, which are equivalent to each other, for *Pen* is Cornish for "head," and *sans*, "holy."

The next feature in the existing dialect is the employment of some words not intelligible to the ordinary English reader, who may search for them in vain, in the dictionary, or among the provincialisms of other parts of the kingdom. I cannot pretend to give a list of these, but it will suffice to mention the verbs *scrowl*, *skud*, *skat;* the adjectives *wisht* and *brave* (corrupted from *brae* or *brea*, "great," as in *Carn-brea*, "great-hill;) and the adverbs *fy*, [truly] *pure*, [old Cornish for "very,"] &c.

Lastly, there is the addition of ey, and ez or es to many English verbs; the former in the infinitive, indicative, and imperative moods, and the latter in the imperative only.*

There is one part of the subject which I have not space to enter on here, although it ought to be noticed—and that is the influence of accent on the durability of a language, with its effect on prefixes; and the loss or change of certain letters resulting from combination. It will be enough to allude to this, leaving it for the consideration of those who have more time, and better qualifications than the writer, for such an enquiry.

The ancient Cornish language lies like a buried city under our feet.—We pass to and fro above it, but heed it not in the bustle of every-day life. Yet in its words there is as much reality as ever was in sculptured obelisk of Egypt or marble slab of Nineveh; for they hide treasures of history, never recorded by the pen, but not the less true or accessible to diligent search. It is for Cornishmen to say whether this search shall be made or not; and it is but reasonable to hope that a language, which has proved so interesting to a foreign prince, as to bring him to our shores for the purpose of investigating it, may also excite some interest among the descendants of the men who spoke it.

* As in the sentence "Comez here and thrashey you!" or in "Goes into the linnay and get a brush; I'll paintey a bit!" &c., &c.

THE FIRST CHAPTER OF GENESIS IN CORNISH.

1 En dallathvaz Dew aveth 'wraz neve ha' noare.

2 Ha'.thera an noar heb roath, ha gwag, ha veth an tewlder war bedgeth a'n downder; ha sperez Dew rig gwayath war bedgeth an dowrow.

3 Ha Dew lavarez, Gwrenz boz goollo: ha enathera goollo.

4 Ha Dew gwellas a goollo, tro va dah; ha Dew rig deberrhee an gollo thurt an tewlder.

5 Ha Dew a criaz an goollo, Deeth, ha an tewlder ea griaz Noz; ha gothewar ha metten o an kenza journa.

6 Ha Dew lavaraz, Gwrenz ena boz ebbarn en creez an dowerou, ha g'renz e deberrhe an dowerou thur't an dowerou.

7 Ha Dew 'wraz an ebbarn, ha theberhaz an dowrow era en dadn an ebbarne, thor't an dowrow era euh an ebbarn; ha an dellna etho.

8 Ha Dew criaz a ebbarne, Neve; ha gothu har ha metten o a nessa journa.

9 Ha Dew lavaraz, Gwrenz an dowrow en dadn an nêf bos cuntellyes warbarth tha idn thellber, ha gwrenz an teer zeah disquethas; ha an dellna etho.

10 Ha Dew a griaz an tîr zeah, Noare, contellyans, war barh a'n dowrow e criaz Moar; ha Dew a wellas tro va dah.

11 Ha Dew laveraz, Gwrenz an 'oar dryrag gwelz, ha lusu toan hâz, ha an gweeth toan lavallo warler go' hendah, leb go haaz etta go honnen, war a doar; ha an dellna etho.

12 Ha an 'oar a droz rag gwelz, ha an lozo rig daaker hâz poka e cunda, ha an gwyth toon lavallo, ha go hâz etta go honnen, warler go henda; ha Dew gwellas tro va dah.

13 Ha gothuar ha metten o an tridga journa.

14 Ha Dew lavarez, Grenz enna boz gollow der an ebbarn neve tha deberrhe an dyth thor't an nôz; ha gwrenz an gy bos rag seenez, ha rag termeniow, ha rag journiow, ha rag blethedniow.

15 Ha g'renz boz rag golowder en ebbarn nêf, tha ry gollow war an beyz; ha an dellna etho.

16 Ha Dew gwreaz deaw gollow broaz; an brossn goulo tha roulia deeth, ha an behattna goulo tha rowlia an nôz; e'wraz an sterrer a weeth.

17 Ha Dew rig gorra en ebbarn neve, ri gollo war an bêz.

18 Ha tha rowlia drez an dyth, ha drez an noaz, ha tha deberhee an gollo thurt an tewlder; ha Dew gwelles tra va daa.

19 Ha gothuar ha metten o an padzwara journa.

20 Ha Dew lavares, Grenz an dowro dri rag por meer an tacklow gwayah es toane bownnaz; hac an ethen es a nijgha dres an noar a leaz en ebbarn neve.

21 Ha Dew rig gwrez an puskas broaz, ha keneffra tra bêw ez a gwayah, leb rig an dowrow dry raag pur vear worler go haaz, ha keneffra ethan eskelly warlêr go hâz; ha Dew 'wellaz tro va dah.

22 Ha Dew rig go benegas an gye, cawl, Bethoh lên a haaz, ha dro rag porh meer, ha leno an dowrow en moar, ha gwrenz an ethen dro rag por mear an bêz.

23 Ha gothuar ha metten o a' pempas journa.

24 Ha Dew lavarrez, Gwrenz an bêz dry rag an tacklow beaw, warleer go haaz, an ludnu, ha an tacklow cramyhas, ha bestes a'n doar warleer go hâz; ha an dellna etho.

25 Ha Dew gwrez bestes a'n bêz warleer go haaz, ha'n ludnu warlêr go haaz, ha keneffra tra es a cramyhas war an bêz warlêr go haaz; ha Dew a 'wellas tro va dah.

26 Ha Dew lavarraz, Gerro ny geele dean en agan havalder, warleer agan havalder ; ha gwrenz an gy kymer gallus dres an puscaz a'n moar, ha drez an ethen a'n ebbarn, ha dres an miliow, ha dres ol an bêz, ha drez keneffra tra cramyhaz es a cramyhas war an doar.

27 Della Dew gwiez dên en e honnen havalder, en havalder a'n Dew e gwrez ef ; gurow ha bennow ef a gwrez an gy.

28 Ha Dew rig go benigar an gy, ha Dew lavarras, dothyns Bethenz lên a haas, ha dro rag porh meer, ha lenow an beaz, ha roulia ta ; ha kemer gallus dres pusgaz a'n moar, ha drez an ethen en ebbarn, ha drez keneffra tra vew ez a gwayah war an bêz.

29 Ha Dew laverras, Morro, e ma rez genna ve tha why keneffra lusu an toan hâz, leb ez war enap a'n 'ol noar, ha keneffra gwethan, a es an hâz a'n gwethan a toane haze ; tha why ta ra boz rag boor.

30 Ha tha keneffra bestaz a'n noar, ha tha keneffra ethan an ebbarn, ha tha keneffra tra es a cramyhas war an doar, a eze toane bownans, ema rêiz gennam keneffra lousunan glaz rag booz ; ha an dellna e' tho.

31 Ha Dew a gwellas keneffra tra tro rig a geil, ha meero etho ta por dah ; ha godhihuar ha metten o an whêffaz dyth.

NOTE.—It will be seen that the spelling of the above, which is strictly copied from the original, is very loose. For example, the word "LAVAREZ" [said] is represented in eight forms through the Chapter. It is evident that the SOUND ONLY is given. In many cases the "w" represents "oo."

1861.

Abstract of Meteorological Journal in Bodmin.

BY LIEUT. LIDDELL, R.N.,

Lat. 50° 29′ N., Long. 4° 40′ W. Guage above ground 4 feet—above the sea 330 feet.

Month.	Max. of Bar.	Min. of Bar.	Max. of Ther.	Min. of Ther.	Aver. of Ther.	Rainy Days.	Greatest rain fall in one day.	Monthly fall of rain.	Bodmin average of rain.	Average of rainy days.	Remarks.
	ins.	ins.	deg.	deg.	deg.		inches.	inches.	inches.		
Jan.	30·15	29·26	55	23	40	15	8th 0·56	2·29	5·15	22	
Feb.	30·35	29·16	52	27	42	21	8th 0·86	4·87	2·66	16	
Mar.	30·12	28·96	55	31	45	23	27th 0·48	3·45	3·40	16	The longest drought between April 8 and May 31 ever recorded here.
April	30·27	29·40	72	34	49	6	1st 0·67	1·39	3·03	15	
May	30·26	29·22	70	39	56	5	12th 1·48	2·07	2·90	14	
June	30·00	29·28	75	49	59	25	25th 0·60	2·83	3·50	16½	
July	30·16	28·98	66	51	59½	24	14th 0·85	6·88	3·34	16½	
Aug.	30·15	29·52	71	48	60½	19	8th 0·42	1·96	3·14	17	
Sep.	30·01	28·91	70	45	58	22	26th 0·86	4·26	3·11	14	
Oct.	30·16	29·17	60	43	55½	18	20th 0·73	3·26	3·01	21	
Nov.	30·32	28·80	57	27	43	26	23rd 0·77	6·79	4·66	20	
Dec.	30·25	28·85	51	25	43	14	13th 1·52	4.51	4·86	21	
					51½	218		44·56	44·76	209	

Total fall of rain in 1861, 44·56 inches.

Days with rain, 218.

Average number of rainy days, 209.

Greatest fall in one day, December 13, 1·52 inches.

Average fall of rain in Bodmin, 44·76 inches.

Average fall per diem in 1861, 0·1220 of an inch.

Extremes since 1849 { Greatest rain fall 1852, 59·64 inches.
Least ditto, 1854, 33·15 inches.

Average temperature in Bodmin in 1861, 51½°, being 3° above that of 1860.

TABLE No. 1.

Meteorological Summary of the Weather at Helston, in Lat. 50 N., Long. 5
From Registers kept by M. P. Moyle, Esq.

1861.	MONTHLY MEANS OF THE BAROMETER. Cistern 106 feet above mean sea level.																		
Month.	Mean pressure corrected to 32° Fahr. Greenwich Time. 9 a.m.	3 p.m.	9 p.m.	Mean of monthly means.	Mean Correction for Diurnal range.	True mean of monthly means.	Mean force of vapour.	Mean pressure of dry air.	Mean range of means.	Mean daily range	Corrected absolute maximum observed.	Day.	Corrected absolute minimum observed.	Day.	Extreme range for the month.	Greatest range from 9 a.m. to 9 p.m.	Day.	Greatest range in any two consecutive 24 hours	Between which days it occurred.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.		in.		in.	in.		in.	
January	30.038	30.031	30.045	30.036	.004	30.032	.263	29.769	0.136	0.072	30.475	21	29.483	14	0.992	0.183	2	—.487	12 & 13
February	29.717	29.699	29.701	29.708	3	29.705	.286	29.419	.228	.168	30.694	2	29.043	21	1.651	.452	13	+.791	9 & 10
March	29.832	29.813	29.837	29.827	7	29.820	.291	29.529	.159	.123	30.395	9	29.254	19	1.141	.379	19	—.498	16 & 17
April	30.059	30.061	30.082	30.064	4	30.060	.303	29.757	.074	.046	30.433	10	29.554	1	.879	.136	8	+.234	7 & 8
May	30.052	30.056	30.045	30.048	2	30.046	.333	29.713	.110	.060	30.400	21	29.455	11	.945	.256	12	+.482	11 & 12
June	29.885	29.895	29.908	29.897	3	29.894	.438	29.456	.092	.069	30.194	30	29.433	26	.761	.285	27	+.334	26 & 27
July	29.682	29.698	29.700	29.694	2	29.692	.467	29.225	.136	.094	30.202	1	29.162	5	1.040	.677	4	—.746	3 & 4
August	30.005	30.004	30.009	30.006	4	30.002	.476	29.526	.131	.082	30.279	25	29.582	2	.697	.362	28	+.412	2 & 3
September	29.840	29.843	29.845	29.843	4	29.839	.432	29.407	.108	.077	30.188	17	29.259	25	.929	.410	26	—.414	25 & 26
October	29.862	29.855	29.876	29.865	6	29.859	.423	29.436	.127	.087	30.183	17	29.193	11	.990	.434	11	+.559	11 & 12
November	29.695	29.699	29.717	29.705	4	29.701	.286	29.415	.175	.103	30.410	19	29.103	10	1.307	.288	10	+.526	10 & 11
December	30.003	29.987	30.005	29.998	3	29.995	.297	29.698	.147	.093	30.361	29	29.093	13	1.268	.496	13	+.917	13 & 14
Means	29.889	29.887	29.897	29.891	.004	29.887	.358	29.528	.135	.089	30.351		29.301		1.050	.362		.533	

REMARKS.—0.121 in. should be added to all the readings of the Barometer for its elevation of 106 feet above mean sea level. The Barometer is a standard, having a bore of 0.6 in. in diameter, with glass cistern 3 in. in diameter, whereby the ivory point of the brass scale can by sight, be brought to a tangent with surface of the mercury at each observation; the open end of the tube has a ring of platina, as recommended by Daniell, for the perfect exclusion of atmospheric air—the tube was filled in vacuo with mercury of the specific gravity of 13.5—and Mr. Glaisher's corrections have been applied to every period of observation taken from the Philosophical Transactions, Part 1, for 1848.

TABLE No. 2.

1861. MONTHLY MEANS OF THE THERMOMETERS.

Mo.	DRY AND WET BULB THERMOMETERS. 9 a.m. Dry.	9 a.m. Wet.	3 p.m. Dry.	3 p.m. Wet.	9 p.m. Dry.	9 p.m. Wet.	Mean of dry Therm.	Correction for diurnal range.	True mean of dry Therm.	Mean of wet Therm.	Correction for diurnal range.	True mn. tem. of evaporation.	Wet Therm. below dry.	Mean tem. of Dew point.	Dew pt. below dry Therm.	Greatest range of dry Therm. from 9 a.m. to 9 p.m.	REGISTERING THERMOMETERS. Mean of all the maxima.	Mean of all the minima.	Approximate mean temp.	Correction for the month.	True mean temperature.	Mean range.	Maximum observed.	Day.	Minimum observed.	Day.	Mean.	Range.	Maximum in sun's rays.	Minimum on grass.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°		°		°	°	°	°
Jan..	43.4	41.7	45.7	44.0	42.4	41.2	43.8	.4	43.4	42.2	.3	41.9	1.5	39.9	3.5	16.0	48.1	40.1	44.1	.2	43.9	8.0	59.	30	28.	2	43.5	31.0	—	—
Feb..	45.5	43.9	48.7	46.2	45.5	43.9	46.5	.3	46.2	44.6	.4	44.2	1.7	42.6	3.6	10.0	49.9	38.7	44.3	.4	43.9	11.2	54.	28	32.	2	43.0	22.0	—	—
Mar..	47.9	45.6	50.9	47.5	46.5	44.8	48.4	1.2	47.2	45.8	.7	45.1	2.1	42.8	4.4	10.0	53.2	42.2	47.7	1.0	46.7	11.0	57.	5 & 6	34.	13	45.5	23.0	—	—
April	50.4	47.7	54.6	50.1	48.3	46.1	51.1	2.2	48.9	47.9	1.4	46.5	2.4	43.9	5.0	10.0	56.7	41.9	49.3	1.5	47.8	14.8	66.	26	34.	3	50.0	32.0	93	30
May.	55.9	52.2	59.8	54.5	53.0	50.5	56.2	2.3	53.9	52.4	2.1	50.3	3.6	46.7	7.2	12.0	63.5	45.3	54.4	1.7	52.7	18.2	79.	17	35.	4	57.0	44.0	102	33
June	60.1	58.1	63.5	59.5	59.1	56.9	60.9	3.3	57.6	58.2	2.0	56.2	1.9	54.2	3.4	8.0	66.1	53.3	59.7	1.8	57.9	12.8	73.	20	47.	4	60.0	26.0	96	44
July.	62.4	59.4	65.8	61.3	60.3	58.3	62.8	2.2	60.6	59.7	1.3	58.4	2.0	58.8	1.8	8.0	68.4	53.7	61.0	1.9	59.1	14.7	73.	14 & 20	47.	2	60.0	26.0	94	42
Aug.	63.2	60.1	66.0	62.2	61.0	58.9	63.4	2.1	61.3	60.4	1.4	59.0	2.2	57.3	4.0	8.0	69.5	54.6	62.0	1.7	60.3	14.9	77.	28	45.	30	61.0	22.0	102	43
Sept.	59.3	56.9	63.0	59.0	58.0	56.0	61.0	1.7	58.3	57.3	1.2	56.1	2.3	54.2	4.1	10.0	65.6	50.9	58.7	1.3	56.9	14.7	74.	1 & 2	41.	17	57.5	33.0	100	38
Oct..	57.1	55.5	60.1	57.5	56.3	54.7	57.9	.8	57.1	55.9	.7	55.2	1.9	53.7	3.4	8.0	62.0	49.9	55.9	1.0	54.9	12.1	71.	15	38.	30	54.5	33.0	90	34
Nov.	44.3	42.9	47.6	45.6	44.7	43.5	45.5	.5	45.0	43.9	.2	43.7	1.3	41.3	3.7	13.0	51.4	39.2	45.3	.4	44.9	12.2	55.	often.	30.	17	42.5	25.0	68	25
Dec..	46.1	44.2	48.5	46.2	45.7	44.1	46.5	.2	46.3	44.8	.2	44.6	1.7	43.4	2.9	9.0	50.3	41.1	45.7	.0	45.7	9.2	55.	often.	33.	thrice	44.0	22.0	63	30
Mns.	52.9	50.7	56.2	52.8	51.7	49.9	53.6	1.4	52.2	51.1	1.9	50.1	2.1	48.3	3.9	10.1	58.7	45.9	52.3	1.1	51.2	12.8	66.1		37.0		51.5	28.1		

REMARKS.—The Registering Thermometers, were made by Negretti and Zambra, and have been corrected by Mr. Glaisher. The Dry and Wet Thermometers were made by myself, and are found to be coincident, very nearly, with a standard Thermometer by Dolland; where there has been any discrepancy, the difference has been correctly noticed and allowed for.

TABLE No. 3.

1861.	WINDS.																														
MONTH.	N.			N.E.			E.			S.E.			S.			S.W.			W.			N.W.			AVERAGE FORCE—0 to 6.				RELATIVE PROPORTION.			
	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	Mean.	N.	E.	S.	W.
Jan.....	1	0	0	0	1	1	7	7	8	4	2	3	12	10	10	4	8	6	3	1	2	0	1	1	2.2	2.4	1.9	2.1	1	9	15	6
Feb.....	5	2	2	1	2	4	2	3	1	3	4	3	3	3	3	10	9	8	2	3	4	2	2	3	2.4	2.8	2.2	2.5	5	4	9	10
March..	4	5	5	0	0	0	0	0	0	0	0	0	1	2	0	8	7	8	7	7	10	11	8	8	2.6	2.6	2.0	2.4	9	0	5	17
April...	8	5	5	4	1	1	10	14	11	2	1	1	0	0	0	0	2	0	3	2	3	3	5	8	1.8	2.2	1.3	1.7	9	13	2	6
May....	8	8	11	6	4	2	4	3	2	0	0	0	2	1	0	2	4	2	0	1	2	9	10	12	1.6	2.1	1.0	1.5	16	5	3	7
June...	5	2	3	2	1	3	6	6	2	1	1	1	2	5	5	7	4	7	0	5	2	7	6	7	2.0	2.1	1.4	1.9	7	6	8	9
July....	0	0	0	1	0	0	0	0	2	0	2	0	3	0	2	15	22	16	4	3	5	8	4	6	2.1	2.3	1.7	2.0	3	1	11	16
August	0	0	0	0	0	0	1	0	2	1	1	1	2	6	1	14	13	12	6	5	11	6	6	4	2.1	2.1	1.5	1.9	3	2	9	17
Sept....	1	0	1	1	0	1	2	1	2	3	1	2	4	4	2	6	12	11	10	4	4	3	8	7	2.4	2.4	1.8	2.3	4	4	9	13
Oct.....	5	2	3	3	2	3	10	13	11	1	1	1	4	5	5	3	3	3	2	4	4	2	1	1	2.1	2.2	1.4	1.9	6	12	8	5
Nov....	5	4	5	5	1	1	0	0	0	1	0	0	1	1	1	5	5	5	7	11	10	6	8	8	1.9	2.4	2.1	2.1	10	1	4	15
Dec.....	2	1	1	5	5	5	7	7	9	3	2	1	2	2	1	4	4	3	4	4	6	4	6	4	2.4	2.5	2.2	2.4	5	12	5	9
Sums...	41	29	33	28	17	21	49	54	50	19	15	13	36	39	30	78	93	81	48	50	63	61	65	69	256	281	205	247	78	69	88	130
Means.	36.3			33.0			51.0			15.3			35.0			84.0			53.7			65.0			2.1	2.3	1.7	2.1	6.5	5.1	7.0	1.1

TABLE No. 4.

1861. WEATHER.

Month.	Average Cloudiness. =0 to 10. 9 a.m.	3 p.m.	9 p.m.	Means.	No. of dry days.	No. of wet days.	No. of days observed.	Amount of rain in cubic inches.	Mean weight of vapour in a cubic foot of air.	Mn. addl. weight requir'd for saturation of the air.	Mean force of vapour.	Mean degree of humidity saturation=1·000.	Mean weight of a cubic foot of air at its respective pressure.	Mn. amt. of water in a vertl. col. of the atmosphere.	Moffat's Ozonometer. 9 a.m.	9 p.m.	Means.	Days in which more than a quarter of an inch of rain fell.	Remarks.
								in.	grs.	grs.	in.	in.	grs.	grs.					
Jan.....	7.2	7.1	6.6	7.0	18	13	31	2.24	3.06	0.39	.263	.886	548.78	3.64	3.1	2.3	2.7	6, 7.	Fog 19, 20, 24, 26; snow 6; gale 1, 24.
Feb	6.6	7.4	6.5	6.8	11	17	28	4.71	3.31	.44	.286	.882	539.89	3.95	3.7	2.8	3.2	6, 7, 8, 12.	Gale 5, 18, 20; hurricane 21; snow 11, 12; hail 6; great flood 8; honeysuckle in leaf, 26; peach in bloom 28.
March.	6.6	6.1	5.2	5.9	9	22	31	2.32	3.56	.55	.291	.859	540.89	4.02	3.9	2.7	3.3	17, 18, 26.	Gale 11, 19; hail 11, 19; snow 21; lunar halo 21; rooks 3; peach and plum 21.
April...	5.0	4.4	3.0	4.1	23	7	30	1.65	3.48	.65	.303	.836	542.95	4.19	2.0	1.5	1.7	1, 2, 3, 6, 7.	Hail 1, 2; lilac 10; apple 18; 1st swallow 19; horse chestnut 20.
May....	5.0	5.0	4.3	4.8	27	4	31	1.60	3.81	1.03	.333	.788	537.10	4.60	1.7	1.5	1.6	10, 11, 26.	Laburnum 1; fog 14, 30.
June ...	6.9	6.5	6.7	6.7	16	14	30	1.74	4.93	.60	.438	.892	519.26	6.00	3.2	1.9	2.5	24, 26.	Wheat in ear 8; bloom 17; oats in ear 21; barley 25; fog 18, 22, 28; thunder 14, 15;
July....	6.7	5.1	7.0	6.1	12	19	31	5.02	5.24	.74	.467	.876	522.89	6.67	3.0	1.9	2.5	3, 4, 5, 12, 13, 14, 19, 24, 25.	Comet 2; fog 13, 20, 24; thunder 27; gale 4, 29;
August	6.5	5.2	6.0	5.9	18	13	31	1.49	5.33	.77	.476	.873	527.71	6.79	2.6	1.6	2.1	1, 7.	Fog 8, 9, 10, 11, 12, 13, 26, 27, 31; wheat out 5; Oats 5; barley 11.
Sept....	5.0	5.2	4.5	4.9	11	19	30	3.06	4.87	.71	.432	.873	528.00	6.18	2.7	1.9	2.3	5, 11, 21, 22, 25.	Fog 4, 5; lightning 23, 24; gale 22, 23, 27.
Oct.....	6.9	6.6	5.9	6.4	15	16	31	2.63	4.78	.58	.423	.880	529.80	5.85	2.0	1.3	1.7	4, 19, 21, 25.	Fog 6, 8, 9; woodcock 15; Fieldfare 25; last swallow 31.
Nov	6.3	5.8	5.8	6.0	4	26	30	7.30	3.32	.32	.286	.910	540.79	3.96	3.5	2.3	2.9	2, 5, 6, 7, 9, 13, 14, 15, 22, 23, 25, 28.	Fog 28; hail 2, 5, 14, 15; lightning 2, 10; gale 4, 9, 25; lunar halo 12; snow 16.
Dec	5.7	5.6	6.4	5.9	20	11	31	2.77	3.43	.37	.297	.902	544.69	4.11	3.0	2.0	2.5	6, 7, 8, 9, 10, 11, 12.	Thunder and lightning 8, 9; gale 11, 12, 23, 24.
Means.	6.2	5.8	5.6	5.9	184	181	365	36.62	4.09	.60	.358	.871	535.23	5.00	2.9	2.0	2.4		

Remarks.—The Rain Gauge is on Howard's principle, 5 feet from the surface of the ground, and perfectly free from any local effects. Wet days include fog and snow. The dew point, weight of vapour in a cubic foot of air, humidity, &c., are deduced from the tables in the Greenwich Meteorological Observations for 1847. The corrections for the diurnal ranges of the barometer and thermometers are from Glaisher's tables: and in all the calculations, and adjustments of the instruments, a strict adherence has been given to the directions of the Astronomer Royal and the Committee of Physics of the Royal Society.

Treasurer in Account with the Royal Cornwall Polytechnic Society.

1861.

Dr.

RECEIPTS.

	£	s.	d.
Balance from 1860	13	0	8
Royal Subscriptions	15	5	0
Members' Subscriptions	132	15	6
Arrears of ditto, 1860	11	2	0
Subscriptions from Mines.			
Wheal Seton	5	5	0
South Frances	5	5	0
United Mines	5	0	0
Wheal Clifford	5	0	0
Dolcoath 1860 and 1861	10	0	0
Fowey Consols	2	0	0
Par Consols	3	0	0
Wheal Friendship	2	2	0
East Wheal Basset	2	0	0
Wheal Basset	1	0	0
Receipts at Exhibition.			
Admissions	123	12	4
Catalogues	14	19	0
Competition	1	13	0
Rent of Tenements	12	1	8
Hire of Hall for County Court	31	10	0
Ditto miscellaneous	49	15	6
	£446	6	8

Cr.

DISBURSEMENTS.

	£	s.	d.
Paid in Prizes and Premiums in Cash	77	10	6
Mr. Johns for proportion of Repairs, Insurance, &c.	13	14	0
Secretary's Salary	80	0	0
Disbursements by Petty Cash as per book, including carriage of goods, attendance, Postages, Travelling, Advertisements, Housekeeper, Agents' Commissions, &c.	61	13	8
W. H. Dunstan, on account of Balance of account for 1860	4	8	0
Expenses of Lime Light, 1860	5	5	4
Waterlow and Sons	3	9	6
Radclyffe, return carriage of pictures, £1 5s., Robinson, £1 7s. 6d.	2	12	6
Cornish Telegraph, old account	1	11	6
Carriage of cases, pictures, &c., to and from Exhibition	16	6	4
Expenses of "Relief of Lucknow."	6	4	2
C. Bullocke and J. C. Stephens' attendance at Exhibition and Travelling Expenses	7	19	10
J. Bullocke, as per Bill	3	17	4
R. C. Richards, £6 18s. 5d., Policeman in attendance, £1 10s.	8	8	5
Rickard, extra money £2 10s. Stamped Cheques, 5s.	2	15	0
Gas	5	16	3
J. Gill, £11 16s. 8d., J. Dixon, £5 3s. 6d., F. H. Earle, £6 5s.	23	5	2
S. Lake, £3 13s. 9d., Netherton, £6 8s. 6d., Genn, £3 6s.	13	8	3
Heard and Sons for Reports	32	6	5
Tonkin, £3 1s. 4d., Green, £4 13s. 7½d.	7	14	11½
Roberts, for men and materials at Exhibition	20	14	1½
J. Earle, £5 1s. 8d., Carne, £3 10s. 6d.	8	12	2
Interest on Loan	14	0	0
Transferred towards reduction of Loan	15	0	0
Balance of petty cash in hand	3	6	4
Balance in hands of Treasurer	6	6	11
	£446	6	8

Audited and compared with vouchers, 28th January, 1862.

ROBERT R. BROAD, } Auditors.
THOMAS ROGERS, }

LIST OF MEMBERS.

HER MOST GRACIOUS MAJESTY.

H. R. H. THE PRINCE OF WALES.

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H. J. Morton, Esq.

Joseph Baxendale, Esq., V.P.

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☞ Those marked with an asterisk are Members of the Committee.

BODMIN.

	£	s.	d.
* Fortescue, Hon. G. M., *Boconnoc*	1	1	0
Foster, Miss E., *Lanwithen*	0	10	0
Hext, Rev. G., *St. Veep*	0	5	0
Hicks, S.	0	5	0
* Hicks, W. R.	1	0	0
Liddell, Lieut., R.N.	0	10	0
* Kendall, N., M.P., *Pelyn*, *Vice-President*	1	0	0
Melville, Philip, *Ethy*	1	1	0
Polglase, J.	0	5	0
* Robartes, T. J. A., M.P., *Lanhydrock*, *Vice-President*	1	0	0
Rogers, Rev. St. Aubyn	0	5	0
Rounsevall, W.	0	5	0
Sawle, Mrs. Graves	0	5	0
Victor, J.	0	5	0

CAMBORNE.

	£	s.	d.
* Bickford, J. S.	0	10	0
Lean, T., *Praze*	0	5	0
Newton, L.	0	5	0
Paull, James, *Rosewarne*	0	10	0
Richards, Capt. T.	0	5	0
* Rule, John	0	10	0
* St. Aubyn, Rev. H. Molesworth	2	2	0
* Smith, G., LL.D., F.A.S., &c.	0	10	0
Smith, W. Bickford	0	10	0
Squire, J.	0	5	0
Vivian, W., *Tuckingmill*	0	5	0
* Vivian, Capt. N.	0	10	0

FALMOUTH.

	£	s.	d.
Addison, J.	0	5	0
Banks, E.	0	5	0
* Barclay, J.	0	5	0
Bastian, H. C.	0	5	0
Batting, Norman	0	5	0
Batting, William	0	10	0
Baynard, James,	0	10	0
Baynard, Mrs.	0	10	0
* Bennetts, J. P.	0	5	0
Bennett, W.	0	5	0
Blamey, B.	0	5	0
Blatchley, J.	0	5	0
Blight, Samuel	0	5	0
Blight, Mrs.	0	5	0
* Boase, Dr.	0	5	0
Boulderson, Miss	0	5	0
Bottrall, C.	0	5	0
Bottrall, Miss	0	5	0
Bottrall, Miss Emily	0	5	0
* Bradfield, H.	0	5	0
* Broad, R. R., K.N.L., K.S.M. *Vice-President*	0	10	0
Broad, Miss	0	5	0
Broad, R. R., jun.	0	5	0
Broad, William	0	5	0
Broad, Mrs. W., jun.	0	5	0
Brougham, Stephen	0	5	0
Brougham, Rev. M.	0	5	0
Bull, Mrs., *Marlborough House*	0	5	0
* Bull, M. V.	0	5	0
Bull, Mrs. M. V.	0	5	0
Bullar, Miss	0	5	0

List of Annual Subscribers.

	£	s.	d.
Bullmore, F. C.	0	5	0
Bullmore, Mrs. F. C.	0	5	0
Bullmore, Dr.	0	5	0
Cardew, Mrs	0	5	0
Cardew, Miss	0	5	0
* Carne, William	1	1	0
* Carne, E. Clifton	0	5	0
Carne, Mrs. E. C.	0	5	0
Carlyon, Rev. C. W., *St. Just*	0	5	0
Claypole, E. W.	0	5	0
Cobon, E.	0	5	0
Cobon, E., jun.	0	5	0
* Coope, Rev. W. J.	0	5	0
Copeland, G., *Constantine*	0	5	0
Cornish, W.	0	5	0
Cuttance, E.	0	5	0
Davies, G. M. Millett	0	10	0
Day, Miss Agatha	0	5	0
Devonshire, Josiah	0	5	0
Downing, Joseph V.	0	5	0
Downing, Miss	0	5	0
* Downing, J., jun.	0	10	0
Dunstan, T., *Constantine*	0	5	0
Earle, J.	0	5	0
Earle, F. H.	0	5	0
Edmonds, Stephen	0	5	0
Egan, Rev. M.	0	5	0
Fenwick, Miss	0	5	0
* Fox, Charles, *Trebah*, *Vice-President*	1	1	0
* Fox, Mrs. C.	0	10	0
* Fox, R. W., F.R.S.	2	2	0
Fox, Mrs. Charlotte, *Tottenham*	0	10	0
* Fox, Miss Anna Maria	0	10	0
* Fox, Miss Caroline	0	10	0
Fox, Joshua, *Tregedna*	0	5	0
* Fox, Alfred	1	0	0
Fox, Mrs. A.	0	5	0
* Fox, A. Lloyd	0	5	0
Fox, Howard	0	10	0
Fox, J. G.	0	5	0
Fox, G. C.	0	5	0
Fox, H.	0	5	0
Fox, N.	0	5	0
* Freeman, John	1	0	0
* Freeman, J. D.	0	10	0
Freeman, Mrs. J. D.	0	10	0
Genn, James D.	0	5	0
* Genn, W. J.	0	5	0
Genn, Mrs. W. J.	0	5	0
Guppy, T. S., M.D.	0	5	0
Gutteres, Rev. F. E.	0	5	0
* Hall, R. T., *Devoran*	0	10	0
Hancock, M. E.	0	10	0
Hart, Thomas	0	10	0
Hawkey and Co.	2	2	0
Helligey, J.	0	5	0
Hodges, S., *Secretary*	0	5	0
Hodges, Mrs	0	5	0
Hooper, W.	0	5	0
Hooper, Mrs	0	5	0
Hughes, J., H.M.C.	0	10	0
Hunt, J. H.	0	5	0
Hustler, William	0	10	0
Hustler, Miss	0	5	0
Jacob, A.	0	5	0
Jacob, M.	0	5	0
* Jago, Lieut., R.N., *Hon. Sec.*	0	10	0
James, Miss C. M.	0	5	0
Johns, T.	0	5	0
Kinsman, Rev. R. B., *Tintagel*	0	5	0
* Kinsman, J. K.	0	5	0
Krabbe, Miss	0	5	0
Lake, Mrs	0	10	0
Lashbrooke, A.	0	5	0
Lean, W.	0	5	0
Mansell, Miss	0	5	0
Maule, Mrs.	0	5	0
Meek, Miss	0	5	0
Molesworth, Mrs., *Penmere*	0	5	0
Molesworth, Miss, *Penmere*	0	5	0
Mead, T.	0	5	0
Moore, Edward	0	5	0
Moore, Mrs.	0	5	0
Moore, Misses G. S. and E.	0	10	0
Olive, M.	0	5	0
* Olver, Jacob, jun.	0	5	0
Olver, T., jun.	0	5	0
Olver, W. Slade	0	5	0
Pengilley, J.	0	5	0
Peters, Rev. M. N., *Penwarne*	1	0	0
* Pender, W. R. T.	0	5	0
Pender, G.	0	5	0
* Phillips, William	0	10	0
Phillips, Mrs.	0	5	0
Phillips, J. H.	0	5	0
Phillips, R. W.	0	5	0
Phillips, Miss C.	0	5	0
Phillips, Miss E.	0	5	0
Philp, James G.	0	5	0
Pollard, H.	0	5	0
Raverty, Capt. 3rd B.N.I.	0	5	0

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	£	s.	d.
Richards, R. C.	0	10	0
* Rickard, Rev., R.F.B.	0	5	0
Robinson, Capt. J. G., R.N.	0	5	0
Roberts, John	0	5	0
Roberts, J., jun.	0	5	0
Rogers, William	1	0	0
* Rogers, Rev. W., *Mawnan, Vice-President*	1	0	0
Rogers, Mrs	0	10	0
* Rogers, R, *Carwinion*	0	10	0
Rule, C.	1	0	0
Selley, W.	0	5	0
Sharpe, R	0	10	0
Sleeman, H. A.	0	10	0
Spargo, T. A.	0	5	0
Squire, Lovell	0	5	0
Squire, Lovell, jun.	0	5	0
Squire, Anson	0	5	0
Squire, W	0	5	0
Squire, Miss Bessie	0	5	0
Stephens, J., *Ashfield*	0	10	0
Sturton, T.	0	5	0
Stirling, Miss	1	0	0
Strongman, B.	0	5	0
Symonds, J., *Constantine*	0	5	0
Symonds, Rev. J., *Baldhu*	0	5	0
Symonds, G., jun.	0	10	0
* Thomas, F. H.	0	5	0
Thomas, W. H	0	5	0
* Tilly, T. H.	0	10	0
Tilly, Mrs. T. H	0	10	0
Tilly, H.	0	5	0
Todd, Brereton	0	5	0
Tonkin, T.	0	5	0
Tregaskis, W.	0	5	0
Tregelles, Misses	0	10	0
Tregelles, Misses M. and E.	0	10	0
Trethowan, J.	0	5	0
Tuke Dr.	0	5	0
Tucker, T., R.N	0	5	0
Tweedy, E. B., *Treasurer*	0	10	0
Tweedy, Mrs. E. B.	0	10	0
Tyacke, Capt.	0	10	0
* Vigurs, R. C., M.B., *Hon. Sec.*	0	10	0
Vigurs, Miss	0	5	0
Vigurs, Miss M.	0	5	0
Vyvyan, Miss C.	0	5	0
Wake, Capt., R.N.	0	5	0
Warn, W.	0	5	0
* Williams, Richard	0	10	0
Williams, Miss	0	5	0
Williams, Miss Emma	0	5	0
Williams, J.	0	5	0
Willmore, A.	0	5	0
Wodehouse, Capt., R.N.	1	0	0
Zupelli, J.	0	5	0

FLUSHING.

	£	s.	d.
Peter, Miss	0	10	0
Warren, Miss	0	5	0

GWENNAP.

	£	s.	d.
* Harvey, Richard	1	0	0
Hawke, E., jun.	0	5	0
Hawke, Misses, C. and J.	0	10	0
Richards, Capt. Jno.	0	10	0
Rogers, Rev. Saltren	0	10	0
* Williams, J. M., *Pengreep*	2	2	0
* Williams, W., *Tregullow*	1	0	0
Wilton, W. H., *St. Day*	0	5	0

HAYLE.

	£	s.	d.
* Poole, J., jun.	0	5	0
* Punnett, Rev. J., *St. Erth*	0	5	0
* Punnett, Macaulay	0	5	0
Tresidder, W. T., *St. Ives*	0	5	0

HELSTON.

	£	s.	d.
* Grylls, Glynn	0	10	0
* Moyle, M. P.	0	10	0
* Popham, C. W., *Trevarno*	1	0	0
* Rogers, J. J., M.P., *Penrose, Vice-President*	1	1	0
* Vyvyan, Sir R. R., Bart, *Vice-President, Trelowarren*	1	0	0

LISKEARD.

	£	s.	d.
Buller, J. F., *Morval*	2	2	0
* Carew, W. H. Pole, *Antony*	1	1	0
* Couch, Jonathan, F.L.S., *Polperro*	0	10	0
Elliot, Samuel	0	5	0
Glencross, Rev. J.	0	5	0
* Pedlar, E. H.	0	10	0
* St. Germans, Earl of, *Port Eliot*	1	1	0

PENRYN.

	£	s.	d.
Carnell, J., *Perran*	0	5	0
Coombes, J.	0	5	0
* Enys, J. S., F.G.S., *Enys*	2	0	0
Gill, T.	0	5	0

	£	s.	d.
Gloyne, R.	0	5	0
Hosken, R.	0	10	6
Hosken, W.	0	5	0
Jenkin, G. A.	0	5	0
* Lemon, Sir Charles, Bart., F.R.S., *Carclew*, *President*	2	2	0
Manser, W.	0	5	0
Read, J. B.	0	10	0
Sara, N.	0	10	0
Sowell, R.	0	5	0
Mead, J.	0	5	0
Reed, T. W., *Trevissome*	0	10	0
* Rogers, T., *Hon. Sec.*	0	5	0
Rogers, T., jun.	0	5	0
Trenery, George	0	5	0

PENZANCE.

	£	s.	d.
* Bevan, C. D., *Boskenna*, *Vice-President*	1	1	0
* Bolitho, T. S.	1	0	0
Carne, Miss	1	1	0
* Couch, R. Q.	0	5	0
Davy, R. V.	0	5	0
Davy, Humphry	0	5	0
* Flamank, James	0	5	0
Henwood, Wm. Jory, F.R.S. F.G.S.	0	5	0
* Pearce, Richard	0	10	0
Roscorla, John	0	5	0
* Rodd, E. H.	0	10	0
* Smith, Augustus, M.P., *Scilly*	2	2	0
* St. Aubyn, J., M.P.	1	0	0
Vibert, J. P.	0	10	0

REDRUTH.

	£	s.	d.
* Basset, J. F., *Tehidy*	2	2	0
* Blee, Robert	0	10	0
* Davey, Stephen	1	1	0
* Davey, Richard, M.P., F.G.S.	1	1	0
Garland, T., *Fairfield*	0	10	0
* Hocking, J., C.E.	0	5	0
Loam, M.	0	10	0
* Magor, J. P.	1	0	0
Reynolds, Charles, *Trevenson*	0	10	0
* Richards, William	1	0	0
* Sims, James	0	10	0
Tweedy, R. M.	0	10	0
Wulff, Capt.	0	5	0

ST. AUSTELL.

	£	s.	d.
* Drake, Dr.	0	5	0
* Jenkins, Rev. D., *St. Goran*	0	5	0
* Tremayne, J., *Heligan*, *Vice-President*	2	2	0

TRURO.

	£	s.	d.
* Barham, C., M.D.	0	10	0
Barham, Mrs.	0	5	0
Baxter, Mrs. Richard	0	5	0
Bond, W. H.	0	10	0
Brune, Mrs. Mary Prideaux, *Padstow*	1	0	0
* Carlyon, C., M.D.	1	0	0
Carlyon, Miss H.	0	5	0
Carter, R. H.	0	5	0
Champion, Mr.	0	10	0
Danbuz, Rev. J., *Killiow*	1	0	0
* Falmouth, Rt. Hon. Viscount, *Vice-President*	2	2	0
Gilbert, Hon. Mrs., *Trelissick*	1	0	0
* Gregor, G. W. F.	2	2	0
Gwatkin, Mrs.	1	0	0
Harvey, H.	0	5	0
* Hawkins, C. H., *Trewithen*	1	0	0
Heard, Edward	0	5	0
* Jago, James, M.D.	0	5	0
Jackson, Mrs. F. C.	0	5	0
Netherton, J. R.	0	5	0
* Phillpotts, Rev. T., *Feock*, *Vice-President*	0	10	0
Polwhele, Colonel	0	10	0
* Roberts, Joseph	0	10	0
Smirke, E., *Vice-Warden of the Stannaries*	2	2	0
* Smith, P. P.	0	10	0
Stackhouse, Miss Emily	0	10	0
Stokes, H. S.	0	10	0
* Tweedy, Robert, *Vice-President*	0	10	0
Tweedy, Mrs. W. M.	0	10	0
Vivian, J. Ennis	1	0	0
* Willyams, H. *Carnanton*	1	0	0
Wotton, T. Dewen	0	5	0

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LONDON.

Baring, T. G., M.P.	£1	1	0
Bunsen, E., *Abbey Lodge, Regent's Park*	1	0	0
W. Dymond, *New Square, Lincoln's Inn*	0	10	0
Fox, S. L., *Tottenham*	0	10	0
Fox, J. J., *Stoke Newington*	0	5	0
Gurney, S., M.P., *Princes-gate, Kensington*	2	2	0
Hunt, Robert, F.R.S., *Vice-President*	£0	10	0
Hunt, Mrs	0	10	0
Smyth, W. W., M.A., F.R.S.	1	0	0
Taylor, John, F.R.S., &c.	2	2	0
Taylor, John, jun., *Bayswater*	1	1	0
* Taylor, Rd. F.G.S., *Hon. Sec., Vice-President*	2	2	0
Trelawny, Sir J. S., M.P., 44, *Hertford-street, Mayfair*	1	0	0
Woodhouse, Miss, *Hampton-wick, Kingston, Surrey*	0	5	0

PLYMOUTH AND DEVONPORT.

* Buller, Sir Anthony, *Pound*	£1	1	0
Balkwill, A. P.	0	5	0
Hancock, R., *Devonport*	0	5	0
Hearder, J. N.	0	5	0
Latimer, I.	£0	10	0
Mount Edgecumbe, Right Hon. Earl of	2	2	0
Mitchell, T. M., *Eton Villa*	0	5	0
Scott, Miss M. L., 10, *South Devon Place, Plymouth*	0	5	0

Jacob, S., *Swansea*	£0	0	5
Pease, J. W., *Darlington*	0	5	0
Rundle, W. W., *Liverpool*	0	5	0
Robjohns, W., *Tavistock*	0	5	0
Savory, James, *Exeter*	0	5	0
Tangye, Brothers, *Birmingham*	0	5	0
Trevithick, T., *Parys Mine, near Bangor, N.W.*	£0	10	0
Tucket, Francis Fox, *Frenchay, Bristol*	1	0	0
Vivian, William, *Parys Mine, Bangor*	1	10	0
Williams, W., *Topsham*	0	5	0

SUBSCRIPTIONS AND DONATIONS FROM MINES.

	£	s.	d.
Dolcoath, *per Capt. Thomas*....£5		0	0
Fowey Consols *per Major Davis*	2	0	0
Par Consols, *ditto*....................	3	0	0
St. Ives Consols......................	1	0	0
South Frances, *per R. R. Broad*	5	5	0
United Mines, *per H. Sims*......	5	0	0
East Wheal Basset, *per W. Richards*	2	0	0
Wheal Basset, *per W. Richards*£1		0	0
Wheal Clifford, *per Williams and Son*		5	0
Wheal Friendship, *per J. Matthews*.................................	2	2	0
Wheal Seton, *per T. H. Tilly*...	5	5	0

DONATIONS

to the present time towards the Fund for Liquidating the Debt

ON THE

POLYTECHNIC HALL.

The following sums have already been subscribed :—

	£	s.	d.
Sir C. Lemon, Bart., F.R.S.	10	0	0
Samuel Gurney, Esq., M.P.	10	0	0
J. M. Williams, Esq	5	0	0
T. G. Baring, Esq., M.P.	2	0	0
J. S. Bickford, Esq	2	0	0
Augustus Smith, Esq., M.P.	2	0	0
Richard Taylor, Esq.	2	0	0
Earl St. Germans	2	0	0
J. F. Basset, Esq	2	0	0
Rev. H. M. St. Aubyn	2	0	0
Admiral Reynolds	2	0	0
John Freeman, Esq	1	0	0
Thomas Garland Esq	1	0	0
Reginald Rogers, Esq	1	0	0
Thomas Rogers, Esq	1	0	0
R. W. Fox, Esq., and the Misses Fox	5	0	0
Rev. J. Daubuz	1	0	0
John Rule, Esq	1	0	0
Richard Williams, Esq.	1	0	0
W. Williams, Esq.	2	0	0

Donations (continued.)

	£	s.	d.
Messrs. Hawkey and Co.	2	0	0
Mrs. Gwatkin	1	0	0
R. R. Broad Esq.	1	0	0
J. K. Kinsman, Esq.	1	0	0
Rev. J. Glencross	1	0	0
W. Phillips, Esq.	1	0	0
Sydney Hodges Esq.	1	0	0
M. P. Moyle, Esq.	0	10	0
Miss Foster	0	2	6
A Friend of the Society	5	0	0
W. Carne, Esq.	1	0	0
W. Hooper, Esq.	1	0	0
Mr. W. Batting	0	10	0
J. Bennetts, Esq.	0	10	0
Transferred by the Society from the Yearly Receipts	15	0	0

ROYAL CORNWALL POLYTECHNIC SOCIETY,

FOR THE ENCOURAGEMENT OF

Science, and the Fine and Industrial Arts.

INSTITUTED 1833.

Patroness:

HER MOST GRACIOUS MAJESTY QUEEN VICTORIA.

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SIR CHARLES LEMON, BART., F.R.S., &c.

Vice-Presidents:

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MR. SYDNEY HODGES, FALMOUTH.

A List of the Premiums and Prizes will be found in the following pages.

LIST OF PREMIUMS AND PRIZES

FOR 1862.

PREMIUMS.

NOTICE.—The Society, in all cases reserves the power of rewarding each communication in proportion to its merit, or even of witholding the Premium altogether.

Competition not confined to members, or residents in Cornwall.

1. MINE VENTILATION.—The following sums have been subscribed for promoting Improved Ventilation in Cornish Mines :—

Royal Cornwall Polytechnic Society	£50
Hon. Mrs. Agar	10
John J. Rogers, Esq..................................	10
United Mines Adventurers..........................	10
T. J. A. Robartes, Esq., M.P.....................	5
Rev. H. Molesworth St. Aubyn.....................	5
Augustus Smith, Esq., M.P........................	5
C. F. Giesler, Esq.	5

Two premiums, one of £50 and another of £25, to be given to the first and second best of the two mines in which, under the circumstances of the case, the ventilation shall be most complete ; regard being particularly had to "close ends," and the extent to which effective ventilation is carried from the main natural draughts. The effectiveness of the ventilation, to be attested in such manner as the adjudicators of the premiums may deem satisfactory. The premiums awarded are to be paid to the adventurers of the mines for distribution.

A premium of £10 for the best model, and a premium of £5 for the best plan, for increasing the ventilation of mines.

2. DRESSING ORES.—A premium of £20, by the Editor of the *Mining Journal*, and by the Society (for such portion thereof as the judges shall consider suitable,) to the originator of improvements in the dressing of ore ; such improvements to have been in successful operation for a period of not less than six months.

3. IMPROVEMENT IN MINING.—A premium of £5, by the Editor of the *Mining Journal*, for the best Paper containing an account of any methods, or plans, practised in any other mining districts, advantageously applicable to the Cornish Mines. To be accompanied by the necessary drawings.

Note.—The introduction of improved methods of drawing the ores and rubbish from the Cornish mines appears to the committee to be worthy of attention with reference to this premium.

4. MINERAL VEINS.—A premium of £2 by the society, and £3 by Sir C. Lemon, Bart., for the most exact account for the phenomena of mineral veins in any mine or district, their dip, direction, variations in productiveness, slides, heaves, &c. The Society being especially desirous of cultivating close habits of observation in our miners, will give prizes for accurately drawn cross sections; for collections of *ore* and *country* in which the relations of one to the other are carefully marked; for drawings and descriptions of any remarkable phenomena observed in lodes, &c.

5. CONSUMPTION OF COAL, &c.—A premium of £5 5s., by John Taylor, Esq., F.R.S., for the most complete and accurate accounts of the quantity of water supplied to the boilers, the number of bushels of coals consumed, and the duty performed by an engine, for a period of not less than six months.

6. WORKING PLAN OF A MINE.—A premium of £5 5s., by the society, for the best working plan of a mine in full work (sections of the lodes not required). The plan to be corrected to some time within three months previous to its exhibition. To be drawn by the person who dialled the mine-workings.

7. A Premium of £5 by the society, for the best machine or model for boring rocks, the effective working of which must be attested.

PRIZES.

MECHANICAL DEPARTMENT.

NATURAL PHILOSOPHY.—CHEMICAL ANALYSIS.
MECHANICAL AND OTHER SCIENTIFIC INVENTIONS AND IMPROVEMENTS:—
MODELS OF MACHINERY, NOT DISPLAYING INVENTION.—
NAVAL ARCHITECTURE.

Inventions and improvements must be accompanied by accurate models or drawings, and explicit descriptions. The drawings to be sufficiently large to be distinctly seen; and all descriptions or communications should be written on foolscap paper, on one side only, leaving 1½ inch margin.

The Society will place at the disposal of the judges, a certain number of prizes to be awarded to apprentices and artisans, for good workmanship.

FINE ARTS.

FOR AMATEURS ONLY.

SCULPTURE AND MODELLING.—OIL PAINTING.—WATER COLOURS.—PENCIL, CRAYONS, ETC.—ENGRAVING AND ETCHING.—LITHOGRAPHY.—ARCHITECTURE.—ORIGINAL DESIGNS ADAPTED FOR MANUFACTURES IN SERPENTINE, GRANITE, PORPHYRY, ETC.

Premiums of £1 each are offered for the following subjects:—

1. For the best filled sketch-book from Nature.
2. For the best series of six flowers from Nature, in chalk or pencil.
3. For the best series of six sketches, in water colours, of different rocks, showing their jointed structure and characteristics.

4. A premium of £2 for the best copy in oil of any genuine picture by the old masters.
5. Ditto of £1 for the best copy in water colour of ditto.
6. For Six outlines of stems and branches of British Trees, on imperial-size paper, giving carefully the forms of leaves and characteristics of stems.
7. For the best series of original sketches of our Cornish Antiquities,—Celtic, Roman, or Saxon.
8. For the best series of six outlines of the human hand or foot, life size, from the cast, or from life ; indicating light and shade by the lightness or strength of the outline.
9. For the best shaded crayon drawing of one of the busts in the Polytechnic Hall, full size, or the bust of any well-known character.
10. For the best engraving on wood, or best lithograph.
11. For the best series of not less than 12 photographs.

SCHOOL PRODUCTIONS.

PRIZES FOR SCHOOLS, OR YOUTHS UNDER 16 YEARS.

A prize of £1, for the best series of six perspective outlines, with original illustrations.

Prizes of 10s., 7s. 6d., and 5s., for the best mechanical drawings.

Prizes of 10s., 7s. 6d., and 5s. for the best series of drawings from objects or models.

Prizes of 10s., 7s. 6d., and 5s., for the best water-colour drawings, original.

Prizes of 10s., 7s. 6d., and 5s., for the best pencil or crayon drawings.

Prizes of 10s., 7s. 6d., and 5s., for the best maps.

Prizes of 10s., 7s. 6d., and 5s., for the best specimen of penmanship.

Note.—Plain writing and printing on a sheet of foolscap, will better meet the views of the committee, than the more decorative styles.

Prizes of 10s., 7s. 6d., and 5s., for the best series of drawings from objects or models, by boys belonging to National and British Schools.

NATURAL HISTORY.

ESSAYS.—LOCAL OBSERVATIONS.—COLLECTIONS OF SPECIMENS, PARTICULARLY SUCH AS ILLUSTRATE THE NATURAL HISTORY OF THE COUNTY.

Specimens must be properly arranged, and accurately named.

Prizes will be especially given for Monographs of any particular family or large genus indigenous to the county, either in Botany or Zoology, such as the *Gramineæ* or the *Hieraceæ ;* the *Holothuriudæ* or the *Medusæ ;* the *Palmipedæ ;* the *Rodentia*, &c., &c.

A premium of £2 2s. for the best Illustrated Journal of Natural History.

A premium of £2 for the best Calendar of Nature, presenting in a tabular form the comparative view of the dryness or moisture of different years ; exhibiting also the advance of the seasons by the time at which various trees, plants, &c., burst into leaf or flower, taking, of course, the same tree each year. The candidates to be under 18 years of age.

STATISTICS.

Communications in this department should relate to subjects connected with the county of Cornwall.

Lander Prizes, for Competitors under 18 Years of Age.

Charles Fox, Esq., offers to the Society, as long as he continues a member of it, the sum of £4 annually, to be distributed in the respective sums of £2, £1, 12s., and 8s., in four several prizes, for the neatest and most correct maps of some one state, province, or European colony, comprising not less than 400 square miles ; or a portion of not less than 100 square degrees of some uncivilised region. These prizes to be called the *Lander Prizes*, in commemoration of those enterprising travellers, Richard and John Lander. The principal rivers, lakes, chains of mountains, line of sea-coast (if any,) and territorial line, should be accurately delineated ; and the sizes of the most important cities or towns, with their latitudes and longitudes, should be correctly marked. The maps should be accompanied by the best information (with reference to authority) respecting the great physical features of the country, such as particulars relating to the principal rivers flowing through it ; the length of course ; breadth at different places ; tributary streams, lakes and canals ; periodical rise, average fall per mile, and the rapidity of current ; the progressive increase of alluvial deposit, and the obstructions which may be opposed to navigation :—the characteristics of the principal chains of mountains in such country ; their general direction, height, geological and mineralogical features, more important passes, limits of perpetual snow, and the elevations at which various trees and plants will flourish on their sides ; or information respecting the population of its principal towns and cities, with the statistics of their trade and manufactures, or the natural productions of the country, zoology, botany, &c.

It is not expected that each map will be accompanied with information on all the subjects specified : they are named as affording hints to guide the juvenile competitors and to prompt them to compilation and original research.

FANCY WORK.

Prizes for the best specimens of Lace-work, Berlin Wool-work, Embroidery, Crotchet, &c.

PLAIN WORK.

Prizes of 7s. 6d., 5s., and 2s. 6d., will be awarded for the best made Linen Shirt, and 10s. for the best pair of Knitted Socks, provided not less than three pairs are sent in, by children under 14.

ESSAYS, SCIENTIFIC PAPERS.

Communications of interest relating to the county, which may be forwarded to the Society, will, if approved by the committee, be printed and circulated with the Society's Annual Report.

FREE LOAN OF DRAWINGS, ETC.

A collection of Drawings and Prints, comprising studies from Raphael, and Lithographs by Harding and others, have been presented to the Society by the Misses A. M. and C. Fox, for the purpose of affording good copies to those schoolboys and others who may wish to borrow them.

Persons wishing to borrow any of the above, must be recommended by a member of the society, and may apply at the Polytechnic Hall, or by letter addressed to the Secretary.

REGULATIONS FOR COMPETITION, &c.

Competitors are divided into four classes:—

The FIRST CLASS consists of Members of the Society; also of persons who pay 3s. to be allowed to compete for prizes. First class competitors are entitled to admission on the first day of the exhibition, after 12 o'clock.

The SECOND CLASS consists of persons of the working order.

The THIRD CLASS consists of Schools for the higher branches of education.

The FOURTH CLASS consists of Schools for the children of the working orders.

The second, third, and fourth classes may compete for prizes without any subscription, but are not entitled to free admission to the exhibition.

Two sealed notes should be sent to the Secretary by every competitor, each endorsed on the outside with some distinguishing motto or private mark. One should contain a full description of the articles sent, and state the class and department in which it is to compete, the other note should be marked "private," and contain the name and address of the competitor.

Articles sent for competition, and the cases in which they are contained should have the same distinguishing marks as the notes mentioned in the last paragraph.

No person shall be entitled to a prize for any article which has appeared at a previous exhibition, unless exhibiting some improvement.

In the Department of the Fine Arts, competitors must distinctly state whether their productions are original or copies.

It is optional with the judges, either to award a medal, or a sum of money instead of it, according to the following scale:—

First Silver Medal	£7	0	0
Second ditto	5	0	0
First Bronze Medal	3	0	0
Second ditto	1	10	0

Medals only, not convertible into money, can be awarded to patented or registered articles.

Persons who may have medals awarded to them shall not be at liberty to exchange the same for their nominal value in money, unless they have received similar medals at any previous Exhibition of the Society.

No competitor may receive more than one medal or prize for similar subjects in the same department at the same Exhibition. (This regulation does not apply to mechanical or scientific inventions.)

No holder of a medal or prize may receive a prize of the same, or a lower value, for similar subjects in the same departments at the *next* two subsequent Exhibitions. But the judges will be empowered to give rewards in special cases to persons excluded by this rule.

The carriage of all articles sent to the Exhibition must be prepaid, unless permission to the contrary has been previously obtained from the committee.

RULES FOR MEMBERSHIP.

An annual subscription of 5s. and upwards constitutes membership.

Persons not resident in the county may become life members on payment of £5.

Each member is entitled to a non-transferable ticket, giving admission at all times to the Annual Exhibition and Lectures, for a subscription of 5s.; and a transferable ticket for every additional 5s.; and is allowed to compete for any of the prizes offered by the Society.

Annual subscribers of 10s. and upwards, and life members are entitled to the Society's Reports.

Subscribers, not resident in the county, paying 5s. and upwards annually, and life members, are entitled to the same privileges as county subscribers of 10s. and upwards annually.

Subscriptions become due, in advance, at Midsummer.

PICTURES BY PROFESSIONAL ARTISTS.

The Society invites professional artists to forward their works to the Exhibition, the carriage of which the Society will pay. The Art Union of Cornwall has arranged to select their prizes from the pictures so exhibited.

N.B.—The Exhibition takes place in the Autumn of each year, and notice is given of the exact date some weeks previously.

Any other information respecting the Society may be obtained from the members of the committee; or the agents in the county, from whom the Reports of the Society may be obtained; or from the Secretary,

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THE ROYAL CORNWALL

POLYTECHNIC SOCIETY,

ESTABLISHED A.D. 1833.

THE THIRTIETH

ANNUAL REPORT

1862.

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SOLD BY Mrs. LAKE AND R. C. RICHARDS.
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PRESENTS TO THE SOCIETY.

The Artizan. From the Editor.

American Journal of Science and Art. From the Editors, Messrs. Silliman and Dana.

Greenwich Magnetical and Meteorological Observations for 1860. From the Royal Society.

Journal of the Chemical Society. From the Society.

Journal of the Franklin Institute, Philadelphia. From the Society.

Journal of the Royal Dublin Society. From the Society.

Journal of the Society of Arts. From the Society.

Lean's Engine Reporter. From the Editor.

London University Calendar for 1862.

Mining and Smelting Magazine. From the Editor.

Memoirs of the Literary and Philosophical Society of Manchester. From the Society.

Rules and Regulations of Ditto. From Ditto.

Proceedings of Ditto. From Ditto.

Official Descriptive Catalogue of the International Exhibition Department of the Kingdom of Italy. Presented by the Royal Italian Commission.

Results of Meteorological Observations in the United States of America, from the year 1854 to 1859, inclusive, made under the direction of the United States' Patent Office and the Smithsonian Institution.

Reports of the Liverpool Compass Committee, 1st, 2nd, and 3rd, year 1855 to 1860. Presented by the Right Honourable the Board of Trade.

Proceedings of the Geologists' Association, 1861, 1862. From the Association.

Proceedings of the Literary and Philosophical Society of Liverpool, 1861-2. From the Society.

Proceedings of the Royal Institution of Cornwall, 1861-2. From the Institution.

Proceedings of the Institution of Mechanical Engineers. From the Institution.

Report of the Royal Institution of Cornwall. From the Institution.

Proceedings of the American Philosophical Society, Nos. 64, 65, 66. From the Society.

Portrait of Sir C. Lemon, Bart. From the Secretary.

Transactions of the American Philosophical Society, held at Philadelphia. From the Society.

Transactions and Report of the Plymouth Institution and Devon and Cornwall Natural History Society, 1861-2. From the Society.

Traitément de la Galène au four Gallois. Par M. L. Moisenet. From the Author.

Etudes sur les Filons du Cornouailles et du Devonshire. By the same.

Report for 1860 of the Smithsonian Institution, Washington U.S. From the Regents.

Health, a Family Medical Journal. From the Editor.

ANNUAL GENERAL MEETING.

The Thirtieth Annual General Meeting was held on Wednesday, February 11th, 1863, Charles Fox, Esq., V.P., in the chair. Among those present were the Rev. T. Phillpotts, V.P., R. W. Fox, J. P. Bennetts, R. R. Broad, Misses A. M. and C. Fox, Miss Molesworth, E. B. Tweedy, T. Rogers, W. Hooper, L. Squire, W. Cornish, T. H. Tilly, Howard Fox, H. Tilly, R. Rogers, L. Squire, jun., W. Warn, &c.

The Secretary read a letter from Sir C. Lemon, expressive of his regret that he was unable to attend.

The Report of the Committee and the Treasurer's report were then read.

On the motion that the Reports now read be adopted and printed,

Mr. L. Squire rose and expressed an objection to that portion of the report which referred to the revenue derived from letting the Hall for entertainments. The Hall not being licensed for theatrical representations, he contended that it was discreditable to the Society to draw any revenue from an illegal source. He also objected to such a lengthened reference to Mr. Bastian in the report. While admitting the great talent and indomitable perseverance of Mr. Bastian, he thought that the notice was out of place, inasmuch as he had not been an exhibitor at the last exhibition. Some alterations were then suggested in the wording of the notice of Mr. Bastian. The Secretary stated that the Hall had only been let on two occasions for entertainments of a theatrical character. On the first occasion it was for what was called a drawing-room entertainment, and on the second for Addison's opera company. As Mr. Squire did not move any amendment, it was then

Resolved :—

That the reports now read be adopted and printed.

Mr. R. R. Broad then referred to the loss sustained by the Secretary in his praiseworthy efforts to increase the Society's funds, and it was unanimously

Resolved :—

That the Secretary be reimbursed to the extent of his loss, viz., £10.

A discussion then followed as to the amount which entitled a subscriber to the Society's Report, and it was

Resolved :—

That the Society's Report be sent to every family in one house who subscribe not less than 15s.

The revised List of Prizes and Premiums for 1863 was then read and adopted.

Resolved :—

That Lord Mount-Edgcumbe, Mr. T. G. Baring, M.P., and Mr. S. Gurney, M.P., be elected Vice Presidents, and that Mr. J. J. Rogers, M.P., be re-elected in the place of those retiring by rotation, namely, Mr. N. Kendall, M.P., Mr. T. J. A. Robartes, M.P., Mr. J. J. Rogers, M.P., and Mr. R. Tweedy.

Resolved :—

That the Officers and Committee be re-elected, and that the following names be added to the Committee in their respective districts :—Mr. C. G. Blatchley and Mr. R. Sharpe, jun., Falmouth; Mr. W. Harvey, Mr. W. Husband, and Mr. H. C. Salmon, Hayle; Mr. C. D. Bevan, Penzance; Mr. R. F. Magor, Mr. C. Reynolds, Mr. T. Garland, and Captain M. Loam, Redruth.

Resolved :—

That, in accordance with the resolutions passed at the last Annual General Meeting, the Secretary be now directed to take the necessary steps to obtain the consent of His Royal Highness the Prince of Wales to allow his name to appear as Vice Patron of the Society.

The Secretary stated that the judges in Naval Architecture had, since the last exhibition, more fully examined Commander Hay's compound protractor, and unanimously decided that it was an invention which merited the award of a medal.

Resolved:—

That the first bronze medal be awarded to Commander Hay's compound protractor.

Resolved:—

That the special thanks of the Society be given to Mr. Isbell, of Plymouth, for his kindness in sending so very valuable a collection of paintings to the last exhibition.

Resolved:—

That the Right Honourable Milner Gibson, M.P., be elected an hon. member of the society:

Resolved:—

That the warm thanks of the Society be given to the trustees and managers of the Savings' Bank, for their constant kindness in allowing the use of their room for committees and other purposes.

Resolved:—

That every subscriber of £1 be entitled to two member's tickets and two transferable ones, and the same for every additional pound subscribed.

The following votes of thanks were then passed unanimously:—

To those ladies and gentlemen who kindly lent specimens of the fine arts, curiosities, &c., at the last exhibition, and who are severally named in the Report of the Committee.

To those ladies and gentlemen who so efficiently acted as judges at the last exhibition.

To those institutions which have kindly presented books and reports of their proceedings to the Society.

Resolved:—

That the thanks of the meeting be given to Mr. C. Fox, for his very efficient conduct in the chair.

REPORT OF THE COMMITTEE.

In presenting their Thirtieth Annual Report of the progress of the Polytechnic, your Committee feel called on to express their satisfaction that the Society has now maintained a course of almost unvarying prosperity to the end of the third decade since its foundation; and, after pursuing its useful career for so many years, it may be considered to be entering upon a new era of its existence. The great and important undertakings which are now being carried on at Falmouth—some of which are rapidly approaching completion—cannot fail to exercise a very considerable influence on the welfare of the Polytechnic Society. Upon the inhabitants of Falmouth has chiefly devolved the task of carrying out in detail those important views in which members in all parts of the county are deeply interested, and the increasing prosperity of the town in which the annual exhibition takes place cannot fail to augment, to a considerable extent, the resources and operations of the committee of management. It may be fairly anticipated, that before the time of the next exhibition the completion of the railway will have brought Falmouth into direct communication with the most distant parts of the country, that the chief difficulties and risk attending the transit of goods to and from the exhibition will be removed, and that the facilities of unbroken railway communication with the town will bring a far greater number of visitors to the exhibition, both of those who assist in the programme of the week, and those who gain instruction and amusement from the objects collected within our walls.

The past year has presented more than one serious obstacle to the success of the annual meeting. It has been rendered memorable by the second of those great Industrial Exhibitions in London, which draw men of enterprise and intelligence from the remotest quarters of the globe, and absorb almost every object of utility, ingenuity, or ornament in one vast, unrivalled centre. Its object was not only felt in the increased difficulty of obtaining objects for exhibition, especially in the mechanical department, but also in the greatly diminished attendance of visitors; and, as a climax to the difficulties your committee have this year had to encounter, the weather during part of the exhibition was so extremely unpropitious, that it was impossible for people even at a short distance to pay their annual visit to the Hall, however much they may have desired to do so. Notwithstanding these drawbacks, however, and the consequent diminution in the annual receipts for admission, your committee have great pleasure in stating that the revenue from other sources has been so satisfactory that they are enabled to meet the current expenses, and transfer a further sum of £20 towards the reduction of the debt on the Hall, as was proposed by Mr. Enys last year. In the past year, therefore, the debt will have been diminished from £280 to £180, and, with the increased receipts which may be fairly anticipated in the coming year, the finances may be considered in a more satisfactory state than they have been for some time past. Although several subscriptions have been lost in the course of the year, from deaths of members and other causes, your committee have, on the other hand, to announce, that as much as £14 has been received from new members. Your especial thanks are due to Mr. Baxendale, for a further donation of £5 to the society, and to Mr. Edward St. Aubyn, for a voluntary annual subscription of two guineas. It will be seen, by reference to the balance sheet, that the deficiency in the receipts at the exhibition, as compared with last year, has been chiefly counterbalanced by the increased receipts from the letting of the Hall, amounting to the large sum of £99 9s. 3d.

In some respects the exhibition of last year was superior to any of its predecessors—more especially in the Natural History and Fine Arts Departments, detailed descriptions of which will be found in the usual place. Your committee feel it their duty to refer especially to the very valuable collection of pictures, so kindly lent by Mr. Warren Isbell, of Plymouth, including the magnificent work which occupied the central place, "William of Nássau and the Money Lenders," and they would recommend that the society should make some especial recognition of Mr. Isbell's kindness in sending so valuable a collection to such a distance. The interest of the past exhibition was also considerably enhanced by the extremely able lectures of Mr. W. Pengelly. This gentleman, a Cornishman by birth, whose powers of observation and intelligence have raised him to his advanced position in the scientific world, visited our exhibition for the first time, and by his lucid descriptions, his varied and extensive knowledge, and clear logical deductions, has left behind him so agreeable an impression, that your committee entertain the hope that they may be able to secure his services on many future occasions. An old and valued friend of the society, Mr. J. N. Hearder, also contributed largely to the interest of the meeting, not only by the beautiful illustrations with the oxy-hydrogen light, but by his general and valuable assistance at all times and in all departments.

Your Committee have observed with much regret that for some time past the Mechanical Department has not been so well represented as the objects of this society would lead them to expect, and that even the greater proportion of those objects which have been recently displayed have been contributed by inventors and manufacturers at a distance, rather than from our own county. As the facilities for the carriage of machinery and models will be so much increased by the completion of the railway, your committee are desirous of exerting themselves to the utmost to obtain a better display in this department, and they would earnestly solicit the co-operation of all those who are interested in this society to forward the objects in view.

In former years you have had the satisfaction of adverting to the progress in science or art, made by some to whom you have at different times awarded medals. Amongst the successful competitors for such prizes was Mr. H. Bastian, of this town. Mr. Bastian's contributions to our annual exhibitions (in botany especially) gave evidence of diligent research, of distinctiveness in observations, accuracy in nomenclature, and of complete preservation of specimens. His subsequent career in London more than confirmed all that his earlier efforts promised. He has taken, at the London University and other institutions, five gold and five silver medals, together with other prizes and scholarships.

Your Committee refer with pleasure to the fact that one of the leading periodicals—*Chambers's Journal*—again refers in very flattering terms to the objects and operations of this society, and the *British Journal of Photography* also, in a highly eulogistic article, recommends photographers to forward their best works to our exhibitions, as a field in which their merits will meet with just appreciation and reward. The very beautiful photograph by Mr. Robinson, "Bringing Home the May," which was first publicly displayed on the walls of the Polytechnic, now occupies the place of honour in the exhibition of the Photographic Society in London.

You have again to regret the death of some well-known members of the society during the past year, though, happily, they are not so numerous as in the previous year. Among these are Mr. R. Williams, for many years your valued treasurer, and Mr. Richard Pearce, of Penzance, who was always active in his endeavours to promote the interests, not only of this society, but also of every laudable enterprise throughout the county. We have also to record the deaths of Mr. J. P. Magor, Mr. Bottrall, Mrs. Bull, and one whose loss, from his intimate connection with the earliest promoters of the society, must be especially regretted, Mr. S. L. Fox, of Tottenham.

In conclusion, your Committee wish to express the great obligation the society is under to those gentlemen who so kindly contributed to the exhibitions. In addition to those already named, your thanks are especially due to Dr. Tresidder, for his very beautiful collection of Indian photographs. To Mr. W.

Bishop, of Plymouth, for a most valuable collection of pictures, including the fine portrait of Gainsborough. To Dr. Drake, of St. Austell, for a rare and valuable set of sketches by the old masters. To Mr. R. L. Liscombe, for some fine landscapes by Pyne, Hulme, and others. Also to the Rev. T. Bewes and Mr. Hughes, for contributions of pictures. To Captain Barntry, Master and Miss Sharp, and Mr. J. J. Rogers, for some interesting curiosities; and to the latter gentleman also for his kindness in presiding on the first day of the exhibition, and for his general assistance in the various departments. To Dr. Scott, of H.M.S. "Royal Adelaide," you are much indebted for very beautiful collections of eggs and shells. Also to Messrs. W. and J. Freeman, for the extremely fine specimens of polished granite which they were again so kind as to lend. To the Rev. F. Trestrail, for a collection of East Indian ferns. To Mr. Howard Fox, for a very choice collection of British lichens, collected by the Rev. T. Salway; and to other ladies and gentlemen who kindly contributed and assisted on the occasion.

THE ANNUAL EXHIBITION.

The Thirtieth Annual Exhibition was opened at the Polytechnic Hall, on Tuesday, September 23. The weather, which had been threatening early in the morning, cleared as the day advanced, and at eleven o'clock the tide of fashionable visitors commenced. The Hall, as usual, displayed the busts of Cornish worthies round the front of the galleries, connecting Boscawen and Borlase with living representatives of the science of the county and friends of the society, while at the end of the Hall, behind the president's chair, were portraits of old Carew, the county historian, Sir H. Davy, Opie, Mr. J. Taylor, and Professor Hunt. The marble bust of the Duke of Cornwall, with its beautiful pedestal of porphyry, the gift of the late Mr. Treffry, was of especial interest now that his Royal Highness is just coming of age, and about to give the country a Princess of Wales to share his future throne. In the centre of the Hall was the large fountain, arranged with different ferns, the *Osmunda regalis* wreathing the centre pipe. Those parts which were not required for the more legitimate objects of the Exhibition were occupied with show stands for select stock of leading manufacturers and tradesmen.

Owing to the great number of articles sent to the International Exhibition, and the consequent difficulty of obtaining models and inventions, the display in the Mechanical Department was not so good as usual, although of patented objects exhibited to obtain the sanction of the society there were many; some of them of value. Among them were sewing, washing, and mangling machines, and an improved meat roaster, which continually bastes the joint by an application of the chain pump. Other machines applied the principle of the pug mill to the baking of bread and the mincing of meat; and another familiar principle of the scavenger's cart, which sweeps up the mud by revolving brushes lifting it into the cart, was conveniently and economically applied to a revolving carpet sweeper. A very useful instrument for flockmasters was a lantern, in which, by a simple arrangement, the lamp supplies warm water and warm milk for weak or sickly lambs or calves, being furnished with a teat, by which the invalid may conveniently take the refreshment. There was a convenient and preferable substitute for an umbrella for carriages, safes, locks, a marine steam governor, a steam guage, a plan for maintaining communication between railway carriages and the guard, and for lessening the danger of going off the rails, an improved miners' dial, and various other inventions, which will be noticed by the judges in their report. A working miner exhibited a double clock, with one pendulum, which at least displays great ingenuity in the maker, and suggests the conclusion that he is out of his place in working underground. A model of a pyrometer for measuring the expantion of different solids by heat, made by "an apprentice," was creditable to him, as it embodies the essentials of the principle; but the inventor does not seem to have been aware that the same principle has been applied in a much more effectual form for some years past.

In the department of Naval Architecture there were two models of great interest—one of a plan for iron keelsons and beams, the other a plan adopted in an iron vessel lately built at Hayle Foundry, in which water ballast is used, the water being contained between the ship's bottom and a floor, which is so attached as to give increased strength to the ship, and to afford additional security, since a hole in her bottom would open into her water cells, and not into the hold. The additional cost is only 30s. per ton in building, and it is a source of continual economy in coasting ships, in avoiding the cost of ballast, and the expense and delay of loading and discharging it.

The Natural History department was of much interest. There were several marine aquaria, with beautiful and rare actiniæ, and good collections of dried plants and mosses. But the most valuable portion was a collection of preserved fish, by Mr. W. Loughrin, of the Coastguard, Polperro. Mr. Loughrin is well known as very successful in this work—the preserved fish in the Museum of the Royal Institution, at Truro, were obtained from him, having been shown at a former exhibition of the Polytechnic Society, but these last exhibited were very superior. Some of them retained so fully the natural colour and appearance, that they would scarcely be distinguished in the market. Among them were the pike, a fine specimen, of 20 or 25 lbs., sturgeon, salmon peel, sea trout, bass, hake, red and grey mullet, bream, flying-fish, blue shark, spotted dogfish, &c. The exhibitor has been equally successful with specimens as small as prawns. But the most remarkable feature is, that in some specimens he has succeeded in preserving the natural eye with its proper character and colour. The subject is of very great interest to naturalists, for these results of his knowledge and skill show that our museums may be easily supplied with what they now generally want—a satisfactory collection of fishes. With these Mr. Loughrin exhibited a very pretty muff, made from the silky byssus of the Pinna Ingens, sufficiently beautiful to take its place among similar articles of luxury, if only the fish were obtainable in larger quantities. The colour here is a shaded maroon, but the Pinna of the Mediterranean, P. Nobilis, has the byssus of a bright golden yellow. In this department was a collection of eggs and shells, collected by R. T. C. Scott, Esq., R.N., in his travels in different parts of the world. The shells were excellent specimens, and the collection of eggs was also very extensive, and included many which are rarely seen, as the bustard, the stork, the vulture, &c. In this department also was an interesting collection of birds' feet, by G. Fox, and a clever book of Observations in Natural History, by W. L. Fox.

Of Cornish Ornamental Stones, Mr. Pearce, of Truro, had a fine display. In the centre of the stand was a magnificent nine-light candelabrum, 8½ feet high, enriched with acanthus leaves, and made of the richest red and green serpentine. The red, in particular, was such as we rarely see. Another beautiful specimen was a vase of red serpentine, wreathed round the neck with foliage of the green variety, and with a winged head of Mercury in bas-relief. With these they had several other works in this very beautiful stone, a polished table of pudding-stone, and polished specimens of porphyry, Cornish malachite, fluor, agate, and asbestos. Messrs. Freeman exhibited a very fine chimney-piece of polished granite.

Adjoining this was the Department of Fancy Work, in which was placed conspicuously a work of great skill and patience, a figure of our Saviour, in worsted work, as large as life.

In every portion of the Fine Art Exhibition the display was of unusual excellence. The works of ancient painters were numerous, and generally of considerable merit—not a few of them pre-eminently so; and in the productions of modern artists, both those resident in this county and elsewhere, as well as in those by amateurs, the collection was particularly rich.

Among the contributors of pictures by old and modern masters, Mr. Warren Isbell, of St. Andrew's Lodge, Plymouth, and Mr. W. Bishop took the leading place. The first of these gentlemen sent a noble collection of fourteen rare and valuable pictures. The chief of these, the largest, most elaborate, and valuable work in the exhibition, was the painting by Claudius Jacquand, "William of Nassau and the Money Lenders,"—formerly in the collection of the late King of Holland. Of this William of Nassau, who was surnamed "The Silent," and of whom it was said "Tacendo parla, parlando incanta"—

> "His silence was expressive,
> His speech was irresistible,"—

we learn that "he was a man of great courage and unflinching determination; and when others of equally high family had succumbed and suffered, there rallied around him numerous staunch and heroic adherents to oppose the cruel and tyrannical

Duke of Alva. He succeeded in casting off the supremacy of Spain, in abolishing the Inquisition, and establishing the independence of the seven provinces; but, in order to effect this, funds were necessary, and he, as one of the richest nobles of Holland, pledged the family plate, rarities of art, and jewels, in order to raise the 'sinews of war.' He did not, however, long enjoy the title of Stadtholder, with which he was invested, for he was assassinated by a minion of Philip II., in 1584, leaving, however, his mantle to his son Maurice." The artist has selected for the subject of his picture the moment when the money lenders appear before William, and the family plate, jewels, and rarities are spread before them. The grouping of the numerous figures introduced, and the varied feelings which may be supposed to belong to the different groups—the calm dignity and high and noble resolution of William, the earnest attention of his followers, the evident regret and vexation of the ladies of his household at parting with their jewels, and the keen and grasping natures of the money lenders—are all depicted with wonderful ability. It is, indeed, a truly great work, and was well deserving the post of honour which it occupied at the end of the Hall. Surrounding this were most of the other pictures contributed by Mr. Isbell. They included Pickersgill's "Œdipus cursing his Son;" "After Trafalgar," by Knell; "A Calm" and "A Storm," by Gabè, a French artist, two very pretty pictures; a very fine landscape view of Scarborough, by Danby, jun.; another by Pyne; "The Prisoners of Chillon," by O'Neil, an excellent picture; a beautifully painted landscape, with cattle, by J. Wilson; a moonlight view by Crome—an exquisite little gem, and one or two others. Mr. Bishop contributed seven admirable pictures. The first of these which deserves notice was the splendid portrait of Gainsborough, painted by the artist himself. In this the painter is represented in a nearly front view, wearing a blue coat trimmed with fur, his right hand on the back of a chair, holding a pencil, and in his left a sketch book. It formed a most interesting and valuable feature in the exhibition, as affording visitors an opportunity of inspecting a fine specimen of this great master. There were also paintings of a "Shipwreck," by Loutherbourg, and a "Sea Piece under the effect of a Storm," by W. Vanderveldt, both very forcible and striking pictures; two fine views of St. Mark's Palace, Venice, by Canaletti; a very beautiful picture—view in the neighbourhood of Rome, with three cows drinking at a stream, attended by a boy and girl, the former playing on a tambourine, by Carl du Jardin; and a "Landscape," the joint production of Wynants and Linglebach. The latter, although only a cabinet picture, realised in Paris the large sum of £240. The contributions by Mr. R. L. Liscumbe, of Uplands, near Plymouth, amounted to eight in number, and included a view of the Island of Murano and Church of the English Burying-ground, in the Venetian Lagunes, by J. B. Pyne, a small but exquisite picture; two views in North Wales, by F. Hulme; a landscape, by Bath; two interiors, by Condy; a landscape and a sea piece, all excellent pictures. Mr. Radcliffe, Pall Mall, London, Mr. J. Hughes, and others, also contributed paintings and drawings. That belonging to Mr. Hughes was a charming specimen of Cignani, "Bacchanalian Children."

The pictures by local professional artists were very numerous, and generally of great excellence. Mr. Philp sent eleven pictures in oil and water-colours, all displaying his usual ability in the selection and general treatment of his subjects, but evincing the acquisition of greater skill in atmosphere and the expression of light and space, qualities of very difficult attainment and much commended by the London press in noticing his works in the water-colour exhibition. His No. 172, "Pilchard Boats," and 173, "St. Michael's Mount," possessed those beauties in an eminent degree. Also the truthful rendering of the stormy sea in his "Longships Lighthouse," and the quiet breadth and warmth of the "Cottage Scene near Pordenick," were much to be commended. Mr. Hart exhibited eleven or twelve water-colour paintings, which evinced great talent and a marked improvement since last year; Mr. Williams, of Topsham, contributed a number of landscapes, and Mr. Sydney Hodges a number of very finely painted portraits and other pictures, in oil. All the productions of these gentlemen are decidedly superior to anything they ever contributed before. Among the pictures by Mr. Hodges were an admirable portrait of Sir Charles Lemon, Bart., the venerable president, which the artist has presented to the Society; and a very pretty view at Ivybridge, near Plymouth. An old contributor to these exhibitions, Mr. Philip Mitchell, of Plymouth, sent several very charming pictures. Mr. C. E. Brittan, formerly of Truro, but now of Plymouth, appeared this year among the professional artists. His contribution "The Dewerstone," on the Cadover, is a chalk drawing, so finely executed, that it is difficult to detect it from a water-colour painting. Mr. J. Squire, formerly of Truro, but now of Clifton, sent six very beautiful water-colour drawings. Mr. Elliot, Mr. Cole, and Mr. Griffiths, of the Truro School of Art, were also exhibitors in this department; and Mr. J. C. Brewer, of Plymouth, contributed a very beautiful crayon head, and other works.

The amateur productions exhibited gratifying improvement. Mr. R. H. Carter, of Truro, contributed four views in Cornwall, which were really creditable productions, and very greatly in advance of the pictures he exhibited last year. Miss A. L. Mitchell sent two exquisite water-colour drawings, birds' nests, and flowers. Mr. T. Dingle, jun., exhibited two exceedingly clever views at Ivybridge, painted on the spot; and Miss Jackson, of Malton, Yorkshire, a very nicely painted copy of Vandyke's head of Snyders, from the original at Castle Howard. Miss M. L. Jenkins, Truro, contributed a bunch of flowers in a vase, which were very finely painted in oil. Miss Dixon, of Plymouth, exhibited a specimen of a new method of preserving flowers in all their original freshness and beauty of colour. They were very artistically arranged, and are as fresh as the day they were gathered, forming a very pretty picture. Mr. Knight, Miss Bennetts, Miss Drew, Miss Fox, and others, also sent very creditable contributions.

On the side of the room appropriated to the works of amateurs was also displayed a very interesting production, a large photographic picture by Mr. H. P. Robinson—"Bringing Home the May," which was printed from six negatives, by which means both the linear and aerial perspectives were preserved. It was most interesting, alike on account of the manner in which it was produced, the great excellence and finish of the work, and the beauty of the composition.* The subject was suggested by the following lines from Spencer:—

> "When all is ycladde
> With pleasaunce; the ground with grasse, the woods
> With greene leaves, the bushes with blooming buds.
> Youngthes folke now flocken in everywhere
> To gather May-bushets and smelling brere;
> And home they hasten the pastes to dight,
> And all the kirk-pillowes eare day-light,
> With hawthorne buds."

The drawings and paintings under the head of "School Productions" were not so extensive as in previous years. Many of the outline and coloured drawings were very creditable productions, and evinced the possession of considerable skill by the youthful exhibitors. Among them were contributions from the pupils of the Schools of Art at Truro, Penzance, and Falmouth; the British, Training, and St. George's Schools, Truro; Miss Traer's pupils, and Mr. Davies's boys' school, Truro; Falmouth British School; Mr. Chatten's school, Camborne; Trevarth School; together with numerous other contributions from Bodmin, Redruth, Fowey, Truro, Falmouth, and Penzance. In the committee-room were displayed a large number of photographic views, contributed by Mr. W. Michell, St. Austle, Mr. T. Hart, Falmouth, Mr. George Lanyon, Mr. J. N. Tresidder, H.M.I.M.S., and others. Those contributed by the last-named gentleman possessed great interest, from the circumstance of their being taken by himself in India, and of many of them being views of scenes and places in which occurred remarkable events connected with the late Indian mutiny.

* This production has since received the medal of the Photographic Society of London.

THE ANNUAL EXHIBITION.

The Annual Meeting was held shortly after one o'clock, at which time the following were among the company present:—Sir Charles Lemon, Bart., the President of the Society, and party, the Right Hon. Thomas Milner Gibson, M.P., Sir John Duckworth, Bart., Mr. J. J. Rogers, M.P., Mr. Richard Davey, M.P., Mr. W. Williams, Mr. J. Tremayne, Heligan, and Hon. Mrs. Tremayne, Mr. J. F. Buller, Morval, Mr. Enys, of Enys, Miss Foster, Lostwithiel, Mr. Le Grice, Penzance, Mr. R. R. Broad, Mr. R. W. Fox, Mr. Alfred Fox, Mr. Alfred Lloyd Fox, Mr. S. Trevenen, Mr. W. Trevenen, Mr. James Paull, Mr. Hustler, the Ven. Archdeacon Phillpotts, Chancellor of the Diocese, Rev. J. W. Hawksley, Rev. S. Rogers, Rev. J. Perry, Rev. R. Vautier, &c.

Sir Charles Lemon said that Mr. Rogers had kindly consented to take the chair for him on that occasion—a position which he was sorry he could not occupy himself; but he was very happy, under the circumstances, to delegate the duty to Mr. Rogers, because he knew that gentleman would discharge it to the satisfaction of every one present.

Mr. J. J. Rogers then took the chair, and said:—Sir Charles Lemon, and ladies and gentlemen—I feel that I owe an apology to you and to the society for appearing here in the place of our venerable and excellent president; but he has paid me the compliment of requesting me to occupy the situation of chairman for him on the present occasion, and it is with very great pleasure that I comply. I think we may congratulate ourselves and the society, on the prosperous state in which we find ourselves on this, the 30th anniversary; and it must be particularly gratifying to many of those present, who were instrumental in aiding in first establishing the society, on looking around them in the Hall, to see that we are not falling back in the importance and interest of our exhibitions, but that the present is the very best exhibition which the society has ever held since it sprang into existence; for not only is it peculiarly rich in works of art, which make themselves seen on the walls around you, and which are of a number and quality far exceeding those that have been exhibited here on previous years within my recollection, but also in those departments of the exhibition which do not present themselves so prominently and favourably to the eye on a first glance. On the whole, I think you will all agree with me that the society has, on this, its thirtieth anniversary, exhibited a very gratifying degree of progress in those departments which it has been our constant aim and object to stimulate and encourage. To the professional artists our thanks are especially due, for having annually sent to the society's exhibitions really valuable works of art. Especially are these thanks due to Mr. Sydney Hodges, our secretary, Mr. Hart, and others; and I think we have never had such a fine collection of pictures—particularly of water-colour paintings—as on this occasion. There is also Mr. Brittan, who has sent us a truly beautiful chalk drawing, which is so finely executed, that it appears to be a water-colour painting; and it is only by a close inspection that its true character is discovered. Mr. Philp has long exhibited here, and his great merits are well known and appreciated. His pictures, which are numerous, are exhibited on the right hand side of the room, and they display all the excellencies of this distinguished artist. We have also numerous specimens from Mr. Williams, an artist who is well known here, and of others whose names will be found in the catalogue. I may also be permitted to draw your attention to a noble picture at the other end of the Hall—"William of Nassau and the Money Lenders," by a French artist, M. Jacquand, which has been sent here by Mr. Warren Isbell, of

Plymouth; and this gentleman has not only contributed that large and fine picture occupying the centre, but the entire group surrounding it, among which are the works of many distinguished artists. Our best thanks are eminently due to him, as well as to other contributors. On the other side of the Hall are a great number of fine pictures from distinguished artists and amateurs, and we have on this, as well as on other occasions, to tender our best thanks to them and to all those who have contributed valuable works of art from their collections. There are many articles deserving of attention, but I will not weary the company by enumerating them, because they will be referred to much more accurately and ably than I can do by the gentlemen who have undertaken the duties of judges of the different departments, and you will hear the reports from these gentlemen in a few minutes. I may, however, state that towards the other end of the room there are some very fine specimens of serpentine work, from Mr. Pearce, of Truro—particularly the beautiful candelabrum. The Hall has been decorated in the same way as upon former occasions, but there has been some slight alteration, you will perceive, in the arrangements down stairs. They have been carried out under the direction of the gentleman who has discharged the duty in former years, and I think the society is particularly indebted to him. I must not pass on to the reading of the reports without expressing my conviction that to the constant, sedulous, and persevering exertions of our able and excellent secretary, Mr. Sydney Hodges, is mainly to be attributed the great measure of success which has attended these exhibitions; and I am sure that every member of the committee feels deeply indebted to him for the constant and untiring exertions he displays in the discharge of the duties of his office. (Hear, hear.) We know how much of the success of the society is due to the exertions of our secretary—how successful they have been in promoting its prosperity; and we trust that it will long continue to flourish as it has done hitherto under the same excellent and efficient management. (Hear, hear.) Before I sit down, I cannot help alluding to one subject of deep regret to us all, which is the loss that we have sustained in the death of the Prince Consort. It would be vain for me to attempt to add to those eulogiums which have been paid to the memory of his late Royal Highness, and which were so well merited by him; but I do not think it out of place to make a passing reference on this occasion to our serious loss, because it was in the departments of science and art that his Royal Highness always exhibited the deepest interest, and took the most prominent part in this country. He always manifested the strongest desire to promote and advance these two important departments, and, in fact, for years he led the way in them. We may hope that the young Prince who is destined in the course of nature to succeed the Queen as the sovereign of these realms, and whose career England is now watching with interest and anxiety, will become as warm and enlightened a patron of science and art as was his distinguished father. (Hear, hear.) I will only say, in conclusion, that in these days, marked as they are by every kind of intellectual activity in the departments of science and art—rich as we are in scientific discovery and art progress, the promoters of our society deserve the best thanks of the community, because I think you will agree with me that there is scarcely any branch of knowledge or science which is not of great value in itself, and every endeavour to throw light upon it is calculated to benefit the rising generation, as having a tendency to stimulate and encourage them to explore further fields of scientific enquiry. It is by the opening up of new fields of inquiry that they will become better acquainted with the wonderful works of creation, and that they will be better enabled to comprehend and to appreciate the power and wisdom of the Creator.

MECHANICAL DEPARTMENT.

Mr. H. C. Salmon, F.G.S., then read the following report relative to this department:—

Although the mechanical department of the Polytechnic Society may not be so rich in novelties this year as on former occasions, it nevertheless presents many objects of interest, and still more numerous evidences of mechanical ingenuity. Occurring simultaneously with the International Exhibition, ours necessarily suffers from a competition which naturally attracts the choicest specimens of mechanical and engineering skill that our county is capable of producing.

The most important object brought before the attention of the judges of the mechanical department was a deep sea pressure guage, the invention of Mr. Hearder, of Plymouth, a gentleman whose name has been for so many years associated with the Polytechnic Society. The importance of perfecting an apparatus by which the pressure of the water of the ocean may be ascertained at any given depth, and by means of which, conversely, the depth may ultimately be estimated from the pressure, is too evident to need pointing out. Much ingenuity and ability have been directed to this object; but, without offering an opinion in any way depreciatory of what has been already accomplished in this respect, it may safely be said that there remains scope for further improvement. The principle upon which Mr. Hearder's apparatus is founded differs essentially from any hitherto suggested; and without troubling the meeting with a description of what will be better understood by examining the guage itself, it may be well to point out that it consists essentially of a syphon of small bore filled with mercury, the longer arm of the syphon being open to the sea, while the shorter arm opens into a closed glass tube filled with water. As the guage descends, and the outer pressure increases, the outside water presses down the mercury in the longer arm of the syphon, the mercury consequently overflowing by the other arm into the closed tube until an equilibrium between the outer and inner pressure is attained. As the overflowed mercury cannot return when the pressure is removed, the quantity that escapes is a guage of the maximum pressure; this quantity being measured by a graduated scale similar to that used in a thermometer. As the temperature at various depths is unequal, a compensation under this head must be allowed for—the temperature at the maximum depth being ascertained by a thermometer which is sent down with the guage.

The apparatus has quite recently been practically tried by H.M. surveying ship "Porcupine." The results attained there appear to have shown some serious discrepancies, which Mr. Hearder most candidly brought under the consideration of the committee. Considering, however, that the apparatus is so new in principle, and, consequently, imperfectly understood; and that the one used (which is the same as is now exhibited,) was rather rude in finish; this circumstance has not influenced the committee to withhold the fullest reward the society has at its disposal for an apparatus so eminently suggestive, if even, in practice, it should be found to require considerable modification. As Mr. Hearder has already received the highest medal in the gift of the society, his deep sea guage has been awarded a money prize of £5.

Next in importance stands Mr. Wilton's improved miners' dial and theodolite, to which a second class silver medal has been awarded. The improvements introduced are not novelties in themselves; but they are new as applied to mining uses in this county. The candle holder also is deserving of attention; and altogether this instrument is in every respect worthy of the reputation of the maker, and does credit to the county.

Five first class bronze medals have been awarded. The first in the list of these are the models illustrative of the simple forms of crystallography, exhibited by Mr. Jordan, an employé in the Mining Record Office, Jermyn-street, London, and the son of a former secretary of the society. These have already received hon. mention at the International Exhibition, and, in the opinion of the committee, are worthy of high commendation. The advantage of the science of mineralogy to the miner, and the importance of a correct knowledge of crystallography in mastering it, scarcely require pointing out. Yet the study of crystallography is the greatest stumbling-block we meet with in the whole range of natural science, particularly to those who have not received a regular mathematical education. Drawing and written descriptions give a very inadequate notion of the real forms and distinctive features of crystals; and the models which have been hitherto prepared, principally in Germany, have in costliness been rather beyond the reach of the common run of students. These models of Mr. Jordan are, on the contrary, cheap, being cut out from the "nets" shown printed on card-board. Besides, in cutting out these and putting the forms together, the student becomes gradually familiarised with the distinctive features of each simple form.

A steam governor for marine engines, by Miller and Knill, comes next in order, and will be readily understood from the two models exhibited. The principle is both novel and ingenious, and is calculated to meet a most pressing requirement, as the ordinary governor is inapplicable to vessels, particularly in the case of screw engines, which, without some such regulation, are liable to "race" on the screw being thrown out of the water by the motion of the vessel. In considering this form of governor, it must be understood that it is not suggested as being intended to replace the present form where that is applicable. It will be seen from the printed description that it has been found to act well in numerous instances.

A first bronze medal has been also awarded to Bradford's patent washing machine, being an improved form of the one which was exhibited and received a prize last year. This improvement, which is arranged so as to imitate as nearly as possible the action of the hands, has received the commendation of the juries at the International Exhibition, and seems to be an essential advance in the form of washing machines. As these machines are fast becoming a recognised necessity in numerous households, every advance made becomes a matter of considerable importance.

Another medal of the same class has been awarded to some fine specimens of letter-press printing, plain and in colours, exhibited by Mr. John Bellows, of Gloucester. The borders are very superior in ornamentation—almost equal to some of the earlier chromo-lithographs. The committee consider it a fair type of the progress daily making in the art of printing.

Mr. Rundle, of Penryn, has received the first bronze medal for improvements in harness, which evince considerable ingenuity. Mr. Rundle's case is also worthy of notice as containing all the most recent improvements in harness and saddlery which he has introduced into his work.

Seven second bronze medals have been awarded by the judges. Four of these have been given for patented inventions, which, from the testimonials presented, seem to have already attained some amount of practical success. The first of these is a bread-making machine, exhibited by Messrs. Stevens and Co., on a small scale, suited to ordinary domestic uses. On a large scale this machine seems to be already widely used, and is valuable, as it dispenses with kneading the dough by hand—a practice which appears to be productive of many evils.

The next is Ransom's improved steam and gas pipe wrench, of ingenious construction, which has met the approval of the engineering members of the judges of this department.

The other patented machines to which second bronze medals have been awarded are a revolving and self-basting meat screen, by Messrs. Zanni and Co., and an ice making machine, by Mr. G. Ash. These seem to comprise the most recent improvements in their respective machines.

The non-patented articles to which second bronze medals have been awarded are a lantern and lamb feeding apparatus, by Mr. N. Sibley; specimens of aluminium and alumin bronze, by Messrs. Bell, Brothers, of Newcastle-on-Tyne; and a contrivance for curing smoky chimneys, by Mr. Tonkin. The lamb-feeding apparatus received the unanimous approbation of the judges, as being one of the most strong, practical, and efficient yet proposed. The alumin bronze—a compound of that metal and copper—promises to become a most important alloy in many departments of the useful and ornamental arts. It will be seen that it is extremely like gold in its outward appearance. The contrivance for curing smoky chimneys is by a local mechanic, and seems to possess both merit and novelty.

Hon. mention has been awarded in three instances. To a boot and shoe cleaning machine, exhibited by Mr. Rawlings; to a horizontal fin expanding canopy for carriages and boats, by Mr. Scowan; and to Mr. Hay's water-proof glue.

Money prizes—varying from £4 to 10s.—have been made in eight instances. The £4 has been awarded to Mr. T. Vincent, a working miner, of Four-lanes, near Redruth, for a clock with two faces. The award was made more out of consideration of the mechanical aptitude displayed, than as indicating an approval of the exercise of so much ingenuity to such a comparatively unimportant object. £1 10s. has been awarded to Mr. J. Allen, an amateur, for two working models of steam engines, for workmanship. 10s. has likewise been awarded for workmanship to Mr. J. Davidge, for three masonic puzzle-boxes; and a similar amount to Mr. Sydney Hodges, for a most ingenious contrivance for indicating the successive clearance of pillar-boxes, which we may hope to see adopted by the post-office authorities, for its general utility is unquestionable. 10s. (for workmanship) has also been awarded to an amateur, for an inlaid mahogany table. Two sums of 20s. have been awarded: to Mr. T. Basset, for an artificial leg; and the model of a railway train, with means of communication between guard and driver, exhibited by Mr. Dustin. In the latter case, the award was for expenses incurred; the judges being scarcely of opinion that the suggestions were practicable. A sum of £2 was similarly made to the exhibitor of Messrs. Simpson's improved sewing machine, for expenses. A first silver medal having been awarded last year, they were not eligible to receive any other reward.

In conclusion, the committee have only to express one regret, and that is, that there are not any machinery or apparatus exhibited specially bearing on the mining industry of the county—that industry to which Cornwall is so largely indebted for its position and prosperity—with the exception of Mr. Wilton's miner's dial and theodolite.

FINE ARTS.

Mr. Hingston Harvey read the following report of the Judges in the Fine Art Department:—

It is with very great satisfaction that the judges in fine arts notice the marked improvement in the productions of amateurs, in oil and water-colour drawing, as exhibited in this year's collection. The contributions are very numerous, and, with few exceptions, far above the average degree of merit. On examining the names of competitors after the prizes had been awarded, the judges discovered, with great pleasure, that in the water-colour department more than half of the successful exhibitors were ladies, who have this year shown themselves to be true artists, both in choice of subject, and in execution of detail. Nos. 269, 270, "Birds, eggs, and flowers," by Miss Alice Mitchell, of Plymouth, are worthy of special attention; and for these drawings the judges have awarded the society's first silver medal. No. 237, a sketch near Gyllyngdune, by Miss Bennett, is remarkable for its boldness of touch and artistic treatment. For this the judges awarded the first bronze medal. Two clever oils sketches, "Waters meet," and "Kingfisher's haunt," Nos. 220 and 221, by Mr. Dingle, of Yealmpton, are clearly painted, and exhibit great power of manipulation. Mr. R. H. Carter, a self-taught amateur, residing in Truro, exhibits several paintings, No. 230 and following, of great merit; a second bronze medal has been awarded. A second bronze medal has also been awarded to Miss Lucy Dixon, of Plymstock, for a frame of flowers carefully preserved in their natural colours. This process is both novel and interesting. Mullion Island, 257, by Miss Drew, evinces considerable talent; and a group of flowers by W. Bennett, of the Penzance School of Art, is carefully executed. There is an interesting sketch-book of Cornish antiquities, and a clever drawing of an old British grave at Scilly, for which a premium has been awarded. A copy of Vandyke's portrait of Snyders has also received a special premium. As an inducement to juvenile and self-taught artists, several small money prizes have been awarded for deserving productions. The specimens of crayon and pencil drawings are not so numerous as on former occasions. Three large pencilled outlines from nature, by pupils from the Penzance School of Art, deserve notice for the clearness and accuracy of the drawing; and a crayon drawing of a vase, by a pupil of that school, is commended rather for the merit of the drawing than for the beauty of design: A pencil outline, also enlarged from the flat, by a journeyman cabinet-maker, a pupil in the Truro School of Art, is a beautiful specimen of freehand drawing of difficult curves in a design of considerable beauty. A set of six pencil outlines of branches of British trees earns a special premium, and is the more meritorious as being apparently drawn without the aid of a School of Art. An excellent photograph of very large size, from nature, by Mr. Robinson, of Leamington, now for the first time exhibited, deserves to rank among the chief attractions of the exhibition. It has been executed in six different portions, so as to secure the same focus for the entire subject. Sir Henry James has contributed several of his most recent specimens of the useful result of photozincography, a process which promises to be of the highest value in the preservation of important and ancient documents, in the reduplication of such precious works of art. A model in serpentine of the figure of "Apollo," by a tradesman named Dale, of Penzance, is deserving of notice; and to Mr. Pearce, of Truro, the well-known stonecutter, the judges have awarded a silver medal, for his very magnificent serpentine candelabrum, which stands in the centre of the Hall.

In conclusion, Mr. Harvey, by request, called attention to the excellent wigs which were exhibited by Mr. Williams, hair-dresser, of Plymouth.

SCHOOL PRODUCTIONS.—MECHANICAL DRAWING.

The Rev. Mr. Drew read the following report of the judges on mechanical models and drawings:—

In this department the judges are glad to observe that the suggestion of last year has been attended to, and has resulted in a marked improvement in the character and number of the specimens. The prizes have been awarded as follows:—The first to James Thomas, of Camborne Commercial School, for a drawing of a tank locomotive; and the second to John Ellery, No.

659. Awards have been given to some others, amongst which the judges would especially mention Nos. 662 and 663, as being the work of a smith's apprentice. Considering the importance of mechanical drawing in a county like Cornwall, the judges cannot conclude without expressing a hope that even more attention may be paid to this department.

The CHAIRMAN read the following report on school productions —second section—drawings, &c.:—

The judges were pleased to see so large a collection of sketches from nature, and many valuable outline drawings—especially those that were taken from casts, or that were enlarged or diminished from the copy. They would especially direct the attention of competitors to the advantage of drawing from objects, which is the best groundwork for artistic work in after life.

The CHAIRMAN also read the report on school productions—maps and penmanship:—

The judges have much pleasure in reporting a marked improvement in school productions, especially in plain writing. They have awarded the first prize to Richard Corfield, of St. Day; the second to James Hicks, of Trevarth School. A few extra prizes have been awarded on account of general excellence, among which they would especially mention No. 434, James Blamey, Penryn Commercial School. With reference to maps, the judges regret that again there has been but one competitor for the Lander prize; the one sent, to which a prize has been awarded, is a very fair one, both as to execution of the map, and the accuracy of the remarks appended. Considering the liberal premiums offered yearly by Mr. Charles Fox, the judges must express their astonishment that more competitors have not presented themselves. In the general competition for maps, the judges have had great difficulty in deciding between No. 405 (R. Corfield, St. Day,) to which they have awarded the first prize; and 404 (G. H. Thomas,) both being much above the average. An extra prize has been awarded to No. 460 (R. J. Nicholls,) in consideration of the neatness and accuracy of the remarks appended.

NATURAL HISTORY.

The Rev. S. Rogers read the report, as follows:—

The judges in the natural history department are glad to report favourably of the articles which have been submitted to them. They would call especial attention to a most interesting collection of lichens, comprising 400 specimens, well selected and arranged, and in excellent preservation. Two collections of dried algæ are worthy of high commendation, one of them especially. There is a well-mounted collection of umbellatæ. Some well stuffed fishes are also exhibited. There is also an interesting collection of actiniæ. The thanks of the judges are due to Mr. R. T. C. Scott, R.N., for the fine collection of shells, which, with coins and birds' eggs, he has been so kind as to send for exhibition. The judges award a prize for birds' eggs, but it has been decided by the committee that collections of small birds' eggs shall not, in future, be encouraged by the society. The judges have again to thank Dr. Cocks for an interesting paper on dragon-flies, and an addition to the list of the Falmouth fauna. They would be glad to see a larger number of papers, recording observations, either miscellaneous or confined to particular classes of the fauna.

NAVAL ARCHITECTURE AND STATISTICS.

The Chairman stated that no report had been presented in either of these departments, but premiums had been awarded to exhibitors in the former.

PLAIN AND FANCY WORK.

The Chairman read the report of the lady judges, as follows:—

The ladies greatly regret that more schools have not entered into competition, and hope another year the schools in the neighbouring parishes may follow the good example set in Mabe.

The Chairman, in conclusion, drew attention to the numerous excellent photographic views and other art productions, which were exhibited in the committee-room, and to a finely polished granite chimney, exhibited by the Messrs. Freeman, not for the purpose of competing for a prize, but of showing what might be accomplished in the way of polishing granite. The latter was a very interesting object, and was well deserving attention.

This concluded the meeting, the whole of the reports having been read, as formerly, in the Hall.

At half-past three o'clock a numerous party started on an excursion to Penjerrick, the residence of Mr. R. W. Fox, about three miles from Falmouth, which had been thrown open to them by the respected proprietor.

The exhibition was re-opened in the evening, and at half-past seven o'clock Mr. J. J. Rogers, M.P., took the chair, and briefly introduced Mr. Pengelly, F.G.S., who delivered a most interesting lecture on fossil organic remains, which was listened to with the greatest attention by a very numerous audience.

LIST OF PRIZES.

MECHANICAL MODELS AND DRAWINGS.

Patent Bread Making Machine—Stevens's Patent Bread Making Machine Co.—second bronze medal; Improved Steam and Gas Pipe Wrench, second bronze medal; Rawling's Patent Boot and Shoe Cleaning Machine, honorable mention; Working Model of Steam Engine, Mr. J. Allen, jun., second bronze medal; Three Masonic Puzzle Boxes, silver and gold ornaments, with 16 locks each, J. Davidge Smith, 10s.; Contrivance for indicating the successive clearances of Pillar Boxes, to be fixed in the door of pillar posts, S. Hodges, 10s.; Models, illustrative of the simple form of Crystallography, J. B. Jordan, first bronze medal; Mahogany Table, inlaid, H. Jenkin, 10s.; Improved Mining Dial and Theodolite, and Candle holder, Wilton and Co., second silver medal; Patent Marine Steam Governor, Miller and Knell, first bronze medal; Artificial Leg, Thomas Basset, £1; Model of Railway Train, with communication between guard and driver, Mr. Dustin, £1; Veruvolver and Self Basting Machine, G. Zanni and Co., second bronze medal; Lantern and Calf Feeding Apparatus, N. Sibley, second bronze medal; Wheeler and Wilson's Lock Stitch Sewing Machine, exhibited by Mrs. Rowe, 24, Union-street, Plymouth, £2; Ash's Ice Making Machine, second bronze medal; Hays's Waterproof Glue, with various woods, brick, and stone cemented together with it, honourable mention; Model illustrative of Ship Caulking with Hays's Waterproof Glue, honourable mention; Clock with Two Faces, showing London and local time, striking and alarming for each, T. Vincent, £4; Serpentine, designed and manufactured by W. Pearce Truro, second silver medal; Washing and Wringing Machines, Mr. Bradford, Manchester, first bronze medal; Alumin

Bronze, Messrs. Bell, Newcastle, second bronze medal; Inkstand of Serpentine, inlaid with various stones, W. Murphy, £1 10s.; Figure, W. Dale, £2; Contrivance for Preventing Chimneys Smoking, Mr. Tonkin, second bronze medal; Case of Saddlery and Whips, and Cart Bridle, on improved principle, exhibited by Mr. Rundle, first bronze medal; Deep Sea Pressure Gauge, J. N. Hearder, £5.

FINE ARTS.—AMATEURS.

Copy of Vandyke's Portrait of Snyders, from the original at Castle Howard, Miss Jackson, prize £2; The Kingfisher's Haunt, on the Erme, T. S. Dingle, jun., first bronze medal; Lower Newham, Truro River, and a view of the North Coast of Cornwall, after sunset, R. H. Carter, second bronze medal; An Old British Grave, Scilly, Miss Fox, £1; Book of Sketches of British Antiquities, ditto, £1; Near Gyllyngdune, first sketch out of doors, Miss Bennett, first bronze medal; Odd-Fellows' Emblem, R. Hingston, self-taught, 10s.; Series of 22 Drawings, Miss Simmons, 10s.; Four Drawings, Animal Physiology, Robert Jewell, second bronze medal; Mullion Island, from the Cavern, Miss M. F. Drew, second bronze medal; Flowers and Vase, Miss Annie Hockin, second bronze medal; Birds' Eggs and Flowers, Alice S. Michell, first silver medal; Roses, G. Petherick, 10s.; Study near the Bumble Rock, Lizard, J. Knight, 10s.; Flowers, by Miss Scott, £1; Group of Flowers, by Miss Lucy Dickson, second bronze medal; Carved Heron, by Mr. Gatcombe, first bronze medal; Bleu Bridge, near Penzance, S. Mitchell, 10s.

CRAYON, PENCIL, INK, &c.

Six Outlines of Stems and Branches of British Trees, Miss M. Hooper, £1; Vase, original design, S. Thomas, Penzance School of Art, 10s.; Outline from Nature, Miss L. Harris, ditto, 10s.; Ditto, Alfred Oke, ditto, 10s.; Ditto, R. Letcher, ditto, 10s.; Crayon Heads, Miss J. M. Fowler, 7s. 6d.

SCHOOL PRODUCTIONS.—DRAWING AND PAINTING.

Three Pen and Ink Drawings—no instructions in etching—J. H. Thomas, 7s. 6d.; Four Drawings, E. Christiana, Girls' British School, Falmouth, 2s. 6d.; Five Drawing-books, Boys' British School, Falmouth, 2s. 6d.; Cottage at Prislow, H. Handcock, 5s.; View at ditto, J. Shepherd, 7s. 6d.; Cottage at Prislow, G. Wilkins, 2s. 6d.; Ditto, F. E. Dunsford, 2s. 6d.; Cottage at Trevethan, F. Kinsman, knife; Outlines, enlarged from the flat, W. D. Richards, 5s.; Ditto, Francis Dingley, 5s.; Travelling sketches, first attempt, J. H. Barclay, 5s.; Drawing-book, S. Mitchell, knife; Pussy, J. Ellery, 2s. 6d.; Book of Drawings, C. M. Carlyon, 5s.; Ditto, F. Spence, knife; Freehand ditto, three boys, Truro British School, 5s.; Book of Drawings, W. Thomas, 2s. 6d.; Outlines, R. J. Tippet, 2s. 6d.; Designs of Dresses, from Nature, E. Griffiths, 7s. 6d.; Outlines of Ornament, Stephen Terrill, 7s. 6d.; Bust of Clytie, shaded from the round, Miss M. C. Mitchell, 10s.; Two Pilasters from the cast, J. Dungey, 5s.; Outlines, J. H. Beales, £1; Pilaster of the Madeleine, Evan Griffiths, 7s. 6d.

MAPS AND PENMANSHIP.

Copy Book, R. Corfield, 10s. 6d.; Physical Geography of Victoria, Arthur Troup, £1; Map of Europe, J. H. Thomas, 7s. 6d.; Copy Book, Boys' Central School, Truro, 5s.; Star Map, showing the course of the comet of Midsummer, 1862, W. Nash, 2s. 6d.; a Copy Book, by a pupil of Mr. Coombe's Commercial School, Penryn, 2s.; a Copy Book, by a pupil of Mr. Hawken's Trevarth School, 4s.; Copy Book, A. Pascoe, 2s. 6d.; Map of Europe, with book of reference, R. F. Nicholls, 5s.; a piece of writing taken from Shakespeare, ditto, 5s.; Specimen of Writing, John Davany, 2s. 6d.

NATURAL HISTORY.

Three Cases of Birds' Eggs, E. Cobon, jun., 5s.; Book of Observations of Natural History, W. L. Fox, 10s.; Two Cases of Birds' Feet, G. Fox, 5s.; Flora of Helston (order *Umbelliferæ*), James Cunnack, second bronze medal; Two Books of Algæ, J. Boswarva, first bronze medal; Four Cases—Otter Manx, Shearwater, Little Auk, Eared Grebe—J. Couch, 7s. 6d.; Five Books of Wild Flowers of the neighbourhood, collected and arranged by R. Painter, second bronze medal; Case of Stuffed Fish, skins preserved; twelve ditto, ditto; pair Pinna Shells; Muff, made of the beards of the Pinna, William Loughrin, *£5*; Book of British Marine Algæ, Miss Vigurs, £10; Aquarium and Anemones, collected and arranged by J. Coombe, 10s.; Three Cases Birds' Eggs, and eight ditto Shells, W. R. T. Scott, Plymouth, first bronze medal; A list, with short description of the principal wild plants of the sub-classes, *Thalamiflora* and *Calcifiæ*, of the neighbourhood of Falmouth, Edward Doble, 5s.; Seven Tanks of Actiniæ, Miss M. Vigurs, 10s.

PHOTOGRAPHY, &c.

Specimens of Photography and Zincography, Colonel Sir H. James, first bronze medal; Specimens of Printing, John Bellows, Gloucester, first bronze medal.

PLAIN AND FANCY WORK.

Knitted Quilt, by Catharine Nicholas, Mingoose, blind from birth and bedridden, 10s.; Hearth-rug, in Berlin wool, R. Jewell, 5s.; Knitted Shawl, Miss Phillipides Commenes, honourable mention; White Petticoat, Mrs. J. H. Jennings, 5s.; Embroidery Frocks, original designs, made and designed by James Tripp, 7s. 6d.; Baby's Robe, Miss Julia Rogers, Wendron-street, Helston, 10s.;

Quilts, A. Williams, 10s.; Small Model Shirt, A. M. Symonds, honourable mention; Linen Chemise, Clara Robinson, 2s. 6d.; Knitted Worsted Stockings, Mary E. Bowden, 5s.; Set of Tatted D'Oileys, Miss Vigurs, 6s.

MAVAL ARCHITECTURE, &c.

Model of full-rigged Ship, carved in wood, John Cock, £1; Model of a Pilot-boat, scale ⅜ of an inch to the foot, 53 tons, B.M., W. C. Gill, £1 10s.; Model Screw Steamer building, to trade between Bristol and Hayle; Section of a Coasting Vessel recently built by Messrs. Harvey and Co., Hayle, to carry 330 tons dead weight, second bronze medal; Model of a ship, and Model for Iron Keelson and Deck beams in wood vessels, with description, Henry John Warren, Hayle, second bronze medal; Half-breadth Model of Vessel, quarter inch scale, John Caul, shipwright, Padstow, £1; Brig, T. Learwood, £1.

MECHANICAL DRAWINGS, BY YOUTHS.

Tank Locomotive, J. Thomas, 10s.; Wheal Seton Drawing Engine, R. Rule, 2s. 6d.; Locomotive, J. Ellery, 5s.; Plans for Cottages, J. Harris, 5s.; Outlines, by an apprentice, 7s. 6d.; Outlines and parts of Engine, J. H. Faull, 5s.

CURIOSITIES.

Postage Stamps of all Nations, W. C. Squire, 5s.

WEDNESDAY, SEPTEMBER 24.

Wednesday is the first of the days when the charge for admission is reduced from 2s. to 1s., and it has on former occasions proved the great day of the exhibition. For many years the society has enjoyed the advantage of fine weather, and the result has been that visitors have flocked into Falmouth from the neighbouring towns, and the Hall has almost invariably become inconveniently crowded from soon after its opening till its close. As if, however, to prove that even the Polytechnic exhibition is not exempt from those vicissitudes to which all undertakings are more or less subject, the weather this morning proved very unfavourable. On the previous day there was a falling off in the attendance as compared with the first day of the exhibition last year, and it was hoped that this might to some extent be made up by the attendance to-day. In the evening, however, the atmosphere presented a gloomy appearance, and as it advanced, rain began to fall, and the evening proved most uncomfortable. On Wednesday morning the weather was worse, the rain pouring down at times in torrents, and the result was that when the exhibition was thrown open at ten o'clock, instead of the stream of visitors which in previous years began to throng the passages to the Hall, the money taker had almost a sinecure. For ladies to venture from home on such a morning was out of the question, and the few visitors that did arrive almost entirely belonged to the male sex. According to the arrangements for the day, Mr. Hearder, of Plymouth, was to have commenced a description of some of the machinery in the Hall at eleven o'clock, but at that hour there was scarcely anybody present, and it was twelve o'clock before he proceeded with his task, and even then he commenced, not because a much larger auditory had assembled, but because further delay could not be allowed, the annual meeting of the Miners' Association of Cornwall and Devon being fixed for one o'clock. Mr. J. J. Rogers, M.P., having taken the chair, Mr. Hearder proceeded to explain the principles of the bread kneading, washing, and other machines, and his new deep sea sounding apparatus.

At the conclusion of Mr. Hearder's address, the annual meeting of the Miners' Association was held in the committee-room, under the presidency of Charles Fox, Esq. The meeting occupied several hours, which terminated the proceedings of the morning.

The exhibition was re-opened at six o'clock in the evening, and at half-past seven Mr. Pengelly commenced a very interesting lecture, to which he gave the title of "The Arithmetic of Creation," in which he showed that the objects in any and every one of the same departments of creation have definite and constant numerical relations, and that these relations, invariable as they are within the boundaries of any one natural group of objects, vary in different groups.

The weather had by this time cleared up, and the attendance was far more numerous than in the previous evening.

THURSDAY, SEPTEMBER 25.

This day presented a remarkable and gratifying contrast to the previous one, both as regards the weather and the attendance at the Hall, the morning opening calm and fair, and the number of visitors to the exhibition being much greater than on Wednesday. The Hall was opened at ten o'clock, and shortly after company began to arrive. The programme of proceedings for the day included a further description of the objects of interest in the Hall, and the reading of papers which have been submitted to the society, in the committee-room. In the evening the exhibition was opened at half-past six, and at eight Mr. Hearder exhibited his specimens of algæ, illuminated by the oxy-hydrogen light, and his dissolving views of statues in the Crystal Palace to a very crowded hall. At the termination of this, Mr. R. W. Fox announced to the meeting that their secretary, Mr. Sydney Hodges, had presented to the society the very faithful and valuable likeness of their esteemed president which was hung at the end of the Hall. He remarked that it was especially valuable to them, not only from the fact of its being a memorial of one who had been so long associated with them as president of the society—and who still continued their president, although he had withdrawn from the other societies of the county—but as a memorial also of the services of their valued and esteemed secretary, to whom so much was due for the success of these exhibitions. He called upon them to testify their appreciation of Mr. Hodges' valuable present in the usual way. (Applause.)

Mr. Hodges said, in reply, that he had not anticipated having to respond to this public expression of their kind feeling, as he had simply intended to have informed the committee that it was his wish that the picture should become the property of the society, and for the committee to have intimated the same to the members. He had not referred to the subject earlier in the week, as he rather shrunk from any ceremonious presentation, feeling, as he did, that it was the very slightest return he could make for the unvarying kindness he had met with from Sir Charles Lemon and the members of the society ever since he had been connected with it. He trusted that they would continue, not only to have the picture, but their valued president himself, within these walls for many years to come. (Applause.)

On Friday some further explanations of the objects of interest in the Hall were given by Mr. Hearder and others, and in the evening the oxy-hydrogen effects were again exhibited. On Saturday evening Mr. Hodges, the secretary, read a paper entitled "A few thoughts on the International Exhibition," which was listened to with great interest. The weather having been so unfavourable during the week, the exhibition continued open during Monday and Tuesday of the following week, but there were no proceedings of importance, beyond the drawing for the Art Union, which took place on Tuesday.

Through an error in the entries, a very elaborate inkstand in serpentine, inlaid with various stones, was included in the collection of goods sent by Mr. Dale, of Penzance. It is, however, the work of Mr. Murphy, of the same town, and on discovery of the error the judges at once awarded it a prize of 30s. Mr. Brereton Todd's process for the production of antimony is also deserving of prominent notice, as it is one that has cost the inventor many years of patient study, which is at length destined to be rewarded—the Borneo Company having purchased the patent right for a considerable sum.

Observations on some Diseases in Lambs and Poultry, arising from the presence of Parasitic Animals in the Windpipe, or the Air Tubes of the Lungs.

By JONATHAN COUCH, F.L.S., &c.

In the summer and autumn of the year 1861 there prevailed in the eastern portion of our county, and perhaps much more extensively, an epidemic disease among lambs, which proved exceedingly destructive, and which, consequently, excited much notice and enquiry in the public, but for which no adequate remedy was found until the disease appeared to cease of its own accord—or perhaps its ceasing might be ascribed to the want of further subjects liable to its influence. On examination of the bodies of the animals destroyed by it, the opinion of the cause of this disease in the minds of competent observers appears to have been—that its first stage was to be ascribed to the presence of parasitic animals, which were found in the bronchial or air tubes of the lungs—these animals being a species of that genus of worms called Filaria. A second stage was, that inflammation of the lungs was, in no long time, produced by the irritation of the presence of these worms, especially when they had descended lower in the tubes, as they had a disposition to do; and that, finally, a diarrhœa was produced by a sympathetic action of the bowels: after which, the animals became so reduced in strength as to be beyond recovery.

It was announced as the intention of a respectable meeting of landowners and farmers, to offer a reward for the discovery of a remedy for this disease, or, more properly, for a successful method of treatment; but, as this could only be proved successful by trial, which pre-supposes the recurrence of the same disease in another season, with the risk of all its attendant loss, and as those who, in that case, might enter on the enquiry may not be possessed of a sufficient acquaintance with the nature of the action of parasitic animals in living bodies—the presence of which appears certainly to have been the original cause of all that followed in the instances above referred to—it was believed to be of material importance to a successful enquiry, that some observations on this subject should be produced, by attending to which the disease might be the better understood, and so arrested in its earlier stages; or, what is still more important, the predisposition to it be entirely obviated. The paper, of which the substance is now presented to the Royal Cornwall Polytechnic Society, was thus written, in the hope of supplying such suggestions as would effect these desirable intentions; and it has received considerable countenance, when in manuscript, from several gentlemen who had suffered greatly from the disease referred to. As collateral with the same, also some remarks are added on the subject of the injury arising from the presence of parasitic animals in the windpipes of poultry, the notes of which were made many years since, and have been confirmed by subsequent experience and enquiry.

The appearance of this disease in lambs was soon after a very wet and harsh season, in the early part of summer; and this circumstance of the weather may have had important influence in producing a susceptibility to the disease, without being the immediate cause of it. It is in the familiar experience of medical practitioners, whether it regards the human race or animals, that, where such predisposition does not exist, the direct influence of the ordinary causes of disease will have only a slight effect, or perhaps none at all; but where the predisposition does exist, the exciting cause need not to be very powerful in order to produce a formidable effect. Predisposing causes, in reference to animals, may be wet, harsh weather, or improper food; and sometimes there are other influences, which our present state of knowledge does not enable us to explain: among which we may name the less obvious conditions of the atmosphere in regard to the proportions or mode of arrangement of its component ingredients, together with its electric condition. Some of these causes cannot be obviated; but it is a question whether, when the weather is, or threatens to be, wet and harsh, an error is not committed by shearing off the wool or placing the tender bodies of the lambs in a bleak exposure, when a greater degree of protection, rather than less, is obviously needed.

A still more powerful predisposition to a diseased habit, especially of the nature, or a kindred one, of that now in question, is produced by the quality of the food; of which special evidence will be forthcoming in regard to its effects on poultry, and scarcely less decisive as to its influence on the complaint called the rot in sheep, as well as in the case before us. Every kind of creature has its peculiar nature in this respect, and when left to follow the impulses of its instinctive propensity, and the materials are within reach, every one will search for and select that sort which is congenial to its health, according to its age, as well as to the specific habits of its race. The sheep, in its wild or natural condition, is an inhabitant of hilly or mountainous countries, where it enjoys fresh and pure air, free, above all things, from precipitated moisture or the exhalations of decaying vegetables; and where, also, it can feed on plants only there to be found, such as the wild thyme, with other stimulant, or bitter, or aromatic vegetables. If sheep are to be preserved and propagated in a state of health, and especially in the early stages of their existence, nature must be followed in this respect; and so it must be, if health is to be restored in and after disease.

It is an unfortunate circumstance that good, or what is termed high farming, produces a tendency to an increase of the evil of which we are treating; for, as it is the wish of the farmer, in this case, to root out of his ground all plants which tend to consume the richness of the soil without returning to him any apparent advantage, he destroys those very plants which are furnished with juices, the presence of which in the blood would so improve or modify its nature as to render the continued existence of these parasites within the body impossible. It would be poison to them, and they would decay and fall off from their attachment, when compelled to draw their subsistence from it. It is popularly known that frequent change of pasture is necessary to the comfort and well-being of a flock. The poet Bloomfield says:—

> "Sheep, long confined, but loathe their present food;
> Bleating against the homeward gate they meet,
> And starve and pine with plenty at their feet."

And the apparent reason for this conduct is, that in a well-cultivated field a short time is sufficient to enable them to consume all the vegetables growing there which their instinct teaches them to be congenial to their nature, or suitable to their circumstances; and when these have been consumed, although abundance of grass or succulent food may remain, they cannot remain quiet without a change. The belief here expressed is strengthened by the fact, that in one instance a farmer ascribed the freedom of his sheep from the destructive disease, to his having frequently changed the place of their feeding, although he could not assign a reason why he did so; and, in a still more remarkable instance, there were two farms, which are separated from each other only by a hedge, in one of which, that is in high cultivation, a large number of lambs were lost, while in the other, where they were kept in rougher ground, not one became affected by it. A portion of the plants which afford that kind of nourishment which best tends to secure the health of these animals, especially by rendering their blood and secretions ill adapted to the existence or growth of parasitic animals, are the wild thyme, dandelion, mustard, and charlic, with different species of lichens—the last named of which are greedily sought after by the wilder animals of the ruminant order in more northern regions; and there is to be mentioned, as, perhaps, more efficacious than all besides, the common broom, which lambs will eat eagerly, and which is believed to have been a safeguard from the disease to a flock, when all around were suffering from it. It was found, by trial, in Sweden, that sheep will eat 387 sorts of herbs; and it is not improbable that, in addition to that number, there may be other sorts which may be relished by them when they are predisposed to disease, or suffering under it; whereas, in the best pasture usually afforded to them, these health-giving plants are limited to three or four. But even this exclusive farming may be reconciled with a prudent provision as a guard against disease; for if a limited extent of ground were set apart for the growth of the plants above named, to be occasionally visited by the lambs or sheep, the safety thus procured would prove a rich reward for the loss of so small an amount of another kind of produce. There are known instances which show, as well in birds as quadrupeds, that an instinctive craving, as well in the young as in the parent, is very quick to discern what is suitable from that which would be useless or hurtful, of which the following is an example and a proof:—That well-known natural philosopher George Montagu was desirous of rearing from the nest some of our wild birds, which he had been the first to discover in England; but all the food he could think of was useless, and he failed in his endeavours, until he discovered that the parent birds were in the habit of conveying grasshoppers to their brood; and, profiting by this observation, his efforts afterwards were pleasingly successful.

The following remarks on the rearing of poultry are illustrative of the same principle:—When chicken are in an early stage of their existence, they are known to be liable to a disease which is termed the gapes, and which is exceedingly destructive among them. The name is descriptive of the principal symptom, and its existence is caused by the presence of worms, of the class Filaria, in the trachea or windpipe; and not in the stomach or the passage leading to it, as might have been supposed if, when taken up with their food from the ground, they had been ready to lay hold on that surface which first presented itself to them. In a young turkey which died of this disease, these parasites were found toward the lower portion of the trachea; the sides of the tube being red, as if inflamed, from the irritation caused by their attachment to it. The heads of the worms were also enveloped in mucus secreted from the surface. It is remarkable that such was also the case with the lambs which were examined as having died from the disease that was lately so fatal; the parasites being of the same natural family Filaria, and the place of their attachment the lower portion of the windpipe, where the redness of the surface marked the irritation their presence had caused. It seems probable, however, that in the early stage of disease, in both cases, they have laid hold of the upper portion of the organ, and that, in the course of time, they change their place by advancing nearer to the lungs. On enquiry at different farms in my neighbourhood, where poultry were an object of attention, it was found that at one place the disease was not known, but at another, at about the distance of a quarter of a mile, it was common; it was known at another farm, but at one not further distant than 200 yards, they were free from it; so that, if the chicken at the one were suffering, and not too far gone, by sending them to the other, they were restored. The enquiry yielded a similar result in several instances; but it was observed that in the places, for the most part, where the disease was not known, the ground was hard, dry, and elevated, and where it prevails it was indeed high, but moist. Yet that moisture in the soil is not the cause of the disease, will presently appear; and the water which the poultry drank was not only good, but the same of which, from nearly-situated estates, those affected, and those which were not, were compelled to drink. In one instance, where the disease had never before been known, it suddenly made its appearance. But the most instructive instances are the following:—Where chicken were kept in confinement in a house, and fed carefully, all were seized with the disease; but when the chicken have been produced in a nest that has been concealed in a hedge by the mother, and, consequently, have been reared in a state of nature, they rarely suffer from the disease: and, to elucidate the cause still further, a mistress of a farm, who was well known for her skill in rearing all kinds of poultry, was accustomed to place the parent of the brood, and especially the turkey, under a crate or other hollow framework, where the bars were sufficiently open to allow the free passage in and out to the young brood. This was to prevent their wandering; and in this condition the crate was placed where the young ones might have the opportunity of feeding freely on various sorts of insects—as spiders, millepedes, grasshoppers, and emmets; for which purpose, also, their situation was occasionally changed. But, although kept within sight of the house, it happened that the young ones were often destroyed by crows, hawks, and stoats, or weasels; to preserve them from which, they were brought close to the house, where, however, the insect food could not be obtained, and the consequence was, that the security from disease they had hitherto experienced was forfeited, and they became subject to the presence of the parasitic animals. It may, further, be deemed a strong corroboration of the influence of some kinds of food in preserving these creatures from parasitic animals, that, in a fishing town well known to me, where the larvæ of insects are common, from being fly-blown in decaying substances, the presence of parasites, as shown in the disease called the gapes, is not even known by name.

It becomes a question, how parasitic animals are able to obtain admission into living bodies, and especially in what manner they procure access to some remote situations in which they have been found. There is no difficulty in forming an opinion how it is that the eggs and larvæ (maggots) of the botfly are introduced into the stomach of a horse; and we can discern that in the economy of nature that strange situation is necessary for a time, in order to prepare their organisation for the perfect evolution of the fly. The necessity may be the same in the case of other creatures, but we can scarcely imagine how it happens that such apparently inaccessible situations can be reached as those in which we find them; for there is scarcely a part in the body of some living animal that, at some time or other, has not been the resort of a parasite. The inmost chamber of the eye of a horse has had its inhabitant in the shape of an eel, and the fleshy substance of the human arm and leg have had their inhabitants, which, it is also reported, have been discovered even in the intestines of a babe that has never lived to breathe! The sinusses of the skull and the liver, in sheep, are especially liable to the visits of some of these creatures; but, in some instances, when we examine the animal as it lies coiled up beneath the covering of peritoneum, or enclosing membrane, in which not the slightest perforation can be discerned, as also in some of the instances already mentioned, we are led to the conclusion that the egg which produced these beings must have been deposited there from the blood itself, in which it had floated through the system, until it had become deposited in a place adapted to its nature; while others of the same kind may have been lost for want of equal good fortune. If the fluids of the body should have been so medicated as to have been rendered unfit for supporting the life or growth of these creatures, the result is harmless; but, in proportion as it is otherwise, a greater or less amount of destruction must follow.

It is the opinion of Dr. Corbould, as expressed in his philosophical paper on this subject, in the first volume of the "Intellectual Observer," that the well-known fluke of the liver in sheep is introduced from without; and yet in such a manner, that they exist in some (among which are bats and weasels,) that do not feed on herbage, on which the eggs of these creatures are believed to lie; while, on the other hand, they are rarely found, if at all, in the horse and ass, which feed only on such herbage. These are circumstances which can be explained only on the principles already advanced;—that the vital juices of these creatures are proportionately fitted, or unfitted, to sustain their life. But, says Dr. Corbould, these flukes are not parasitical during the entire period of their existence; for, whilst passing through the cycle of their life's development, they frequently change their residence—at times inhabiting either open waters or the dewy moisture of low pasture grounds. The fluke of the liver *(Fasciola Hepatica)* may reach an inch in length; but another fluke *(Amphistoma Conicum)* is also found in sheep. All of them contain both sexes in one body; and their eggs are believed to produce larvæ out of the body, that attach themselves to snails and other soft-bodied animals. The course of nature in the evolutions of these creatures is thus described:—First, there is a time when, in the spring, the mature liver fluke passes off from the animal in which it has lived, at which period its eggs are ready for expulsion, and soon afterwards they are scattered abroad by various agencies; the situation best fitted for hatching them being moist or wet. From each egg proceeds a ciliated embryo, which is capable of moving about, and this, after a time, lays hold of some body that comes near it, especially of a sheep, which, probably, it enters by the mouth; but it may do so in some other way, for the fluke has been seen embedded in the sole of a woman's foot, and behind the ear. Six or seven have been found together within the scalp of the head of a little child. But the liver of cattle is their favourite situation, and there we need not trace further their changes of shape or modes of increase. It is sufficient for us to know, that as the situation where succulent food grows, aids their first stages of life, so the use of it by sheep tends to further the mischief when they have found access to the interior of the animal; and this destructive influence may be guessed at, when we are informed that the loss of sheep in some years, in Great Britain, has amounted to the number of two millions. It is a subject of instructive consideration, also, that in those districts where such enormous loss is sustained, there are some meadows where the disease is never found; this exemption being accounted for by the fact that their surface is often overflowed by salt water. Salt, then, is a preventative of the ill influence of these, and, probably, other parasitic animals; and it becomes a question, in what manner is exercised its preserving power? From the statement already given of the way in which at least one species of these injurious animals is bred out of the body, it is highly probable that the presence of saline matter on the herbage is destructive to the partially-developed creature before it can have had an opportunity of being taken into the body of the animal it feeds upon; but, besides this, an opinion prevails, and is supported by extensive observation in man as well as in other beings, that the freely mixing salt with food, or suffering animals to lick it at their pleasure, is of much efficacy in producing a healthy condition of the blood and secreted fluids, as well as in exciting the proper motion of the stomach and bowels. This, then, is another of the means to be adopted as a general preventative of the hurtful actions from internal parasitic animals, and, it is believed, of the Filaria in the windpipes of lambs, and liver fluke in particular. And of the former of these we would further observe, that if it has not been so generally destructive as the latter, our late experience proves that this does not proceed from its being less destructive than the latter when it exists, but from the less frequent presence of the causes that produce it.

In the first and most simple stage of the disorder produced by the presence of these worms in the tube of the windpipe, the indication should be to procure their expulsion; and there is reason to believe that this may be effected at the same time that the remedial means are pursued which have been already pointed out. For this purpose of expulsion the following proceeding offers the best prospect of success; and it has, besides, the warrant that it has been practised with good effect in the case where the chicken have been suffering from an advanced stage of the gapes. Nor need there be any difficulty in the performance of it, as a state of quietude, with the absence of struggles, can be brought about by the application of chloroform to the nostrils or mouth; and in this manner a great many individuals may be operated on in a short time. The operation consists in slitting open the windpipe lengthwise, for a small space, with a lancet or sharp knife; a slender feather is then to be introduced, which, with a twirl, will dislodge the worms from their attachments, so that they may be discharged with a cough; after which, in the chicken operated on, the slit made with the lancet soon healed, and those which, otherwise, must certainly have died, were soon restored to health. There is no doubt that the same success would attend a similar proceeding in the lamb. A modification of this proceeding in chicken has also been practised but although appearing to be more simple, it is to be questioned whether the modification is not more difficult in the performance and also attended with less success. It consists in dipping a slender but firm feather in the oil of turpentine, and, taking advantage of the stillness produced by the chloroform, in passing it into the tube in which these worms are known to be, and then, with a twirl or two to dislodge them from their holdfast, the feather is withdrawn.

But there is a second stage of disease among the lambs, in which inflammation of the lungs is produced, either by the irritation caused by the presence of these worms in the windpipe, or by their having descended nearer to, or within the lungs themselves. The symptoms then are such as, if the first to be observed, might lead to a mistake concerning the original cause of the disease, and which still maintains an unobserved influence upon it. They are those which indicate an inflammation of the lungs, as shown by a frequent cough and great tendency to thirst. It is probable that the breath is also short and panting; but this has not always been noticed. The treatment which promises the greatest benefit will be the administration of the nitrate of potass in the proportion of two drachms to a pint of water; or, the medicine termed the acetate of ammonia, one ounce in the same quantity of water: half a teacupful two or three times in a day. But there is a third stage in this disease, which is so much the more formidable, as it implies a failure of nature, and which leads to a still greater exhaustion of the animal powers. It is termed the scour, from the condition of the discharges; but, as it is not absolutely fatal, something should be attempted with the hope of amendment; for, in fact, not a few lambs have recovered from it. Its approach may be known by the distension or apparent swelling of the belly, and by a gurgling sound, especially when the creature moves, as if emptiness and flatulency were united together. A little rhubarb may first be administered, and, after this, some tincture of opium, with powdered, or, as it is called, prepared chalk, with catechu. Mutton suet, also, boiled in a mixture of milk and water, with a very small quantity of soda, to cause it to dissolve more readily; or a decoction of the plant tormentil, and milfoil, are good astringents; and it is probable that sheep and lambs would eat the two last-named plants, if they were placed, or permitted to grow, within their reach. They might be useful in the first, as well as the last stage of this disease.

Contributions to the Falmouth Fauna, 1862.

By W. P. COCKS.

"Let us carry ourselves," says Coleridge, "back in spirit to the mysterious week, the teeming workdays of the Creator, as they rose in vision before the eye of the inspired historian 'of the generations of the heavens and earth, in the days that the Lord God made the earth and the heavens.' And who, that hath watched his ways with an understanding heart, could, as the vision evolving still advanced towards him, contemplate the filial and loyal bee, the home-building, wedded, and divorceless swallow, and, above all, the manifoldly intelligent ant tribes, with their commonwealth and confederacies, their warriors and miners, the husband-folk, that fold in their tiny flocks on the honied leaf, and the virgin sisters, with the holy instincts of maternal love, detached and in selfless purity, and not say to himself—Behold the shadow of approaching humanity, the sun rising behind in the kindling morn of creation! Thus, all lower natures and their highest good in semblances and seekings of that which is higher and better. All things strive to ascend, and ascend in their striving. And shall man alone stoop? Shall his pursuits and desires, the reflections of his inward life, be like the reflected image of a tree on the edge of a pool, that grows downward, and seeks a mock heaven in the unstable element beneath it, in neighbourhood with slim water-weeds and oozy bottom-grass, that are yet better than itself, and more noble, in as far as substances that appear as shadows are preferable to shadows mistaken for substance? No! it must be a higher good to make you happy. While you labour for anything below your proper humanity, you seek a happy life in the region of death."

"Eternal life!—Oh! how refin'd
The joy! the triumphs how divine!
When saints, in body and in mind,
Shall in the Saviour's image shine!
Holy and heav'nly be that soul,
Where dwells a hope so bright as this:
How should we long to reach the goal,
And seize the prize of endless bliss."—*Gibson.*

DRAGON-FLIES.

The name given them in England seems much more applicable than *demoiselles*, by which the French distinguish them. They are of an elegant form and beautiful colour, but their habits are sanguinary and rapacious. During the hottest days they may be seen sweeping round ponds and lakes, or sluggish parts of rivers, where they find an ample supply of food in myriads of insects which are there generated.

Reaumur says:—"So far from seeking an innocent nutriment in the pulp of fruits or the nectar of flowers, they are more like *Amazons* than *damsels*, hovering in the air only to pounce upon other insects, which they crush with their powerful mandibles. Should they quit the margin of a pond, or the banks of a rivulet, where they may be seen hawking about in multitudes, it is only to pursue and seize the moth or the butterfly that has fled for shelter to the bushes." In the larvæ, or pupa state, they live, according to *Latreille*, for ten or eleven months in the water, and are engaged in unceasing war with other insects, which, by a singular device, they entrap. They are furnished with two pairs of strong jaws, covered by a mask armed with a pair of forceps; and when anything passes within reach, they suddenly dart forth their masks, open the forceps, seize the unfortunate victims, and bring them within the action of their powerful jaws. The pupa and larvæ are not very different in form from the perfect state, except in the want of wings. They change their skin many times before their transformation. When the period for the final change has arrived, they leave the water, and, crawling up the bank, ascend a stalk of grass or any other plant, and, after a little repose, the back of the thorax splits, and the perfect insect appears in all its beautiful colours, ready to fulfil the purpose of nature, in the propagation of the species. The female deposits her eggs in the water, into which she intrudes the extremity of the abdomen, so as to attach them to the stalks of plants, &c.

Migration of dragon-flies.—*Mr. Woolnough*, of Hollesley, in Suffolk, once witnessed an army of the smaller dragon-flies flying inland from the sea, so as to cast a slight shadow over a field of four acres as they passed. *Meinecken* states that he once saw, in a village in Anhalt, on a clear day, about four in the afternoon, such a cloud of dragon-flies as almost concealed the sun. *Rosel* reports several instances of similar clouds of these insects having been seen in Silesia and other districts. Swarms visited Weimar, in Germany, in 1816; and an immense flight of these insects was seen at Weimar, Eisenach, Leipsig, Halle, and Gottingen, &c., in the month of May, 1839.

Section—LIBELLULINA, M'Leay.

Head large, hemispherical, or transverse; eyes very large; ocelli three—arranged triangularly, or in a straight line; antennæ short, slender, inserted between the eyes, composed of from five to eight joints, the two basal ones the thickest, the terminal ones forming a hair-like style; mouth large; mandibles horny, strong, three gonate, more or less toothed; maxillæ shelly, compressed, strong; thorax thick, deep; wings equal, closely reticulated, erect during repose, or extended horizontally; abdomen long, sub-cylindrical; lanceolate-depressed, or slightly clavate, furnished at the apex with a hooked or lamellated appendage, variable in form, in both sexes and species; legs short, slender, armed with numerous spines; tarsi three-jointed, cylindrical, the basal joint the smallest.

Family—AGRIONIDÆ, Leach.

Head transverse, broader than the thorax; eyes semi-globose, remote; ocelli in a triangle; wings membranaceous, erect, narrow; abdomen linear, cylindrical.

Genus—AGRION, Leach.

Wings very narrow; stigma rhomboidal; areolets mostly quadrangular; abdomen linear, in the male furnished with from two to six appendages, of variable form, in the female, simple.

A. rubellum, Vander Linden. Length 2¼ inches; exp. wings 1½ inch. Locality, Budock Church lane, Budock Common, &c.

A. elegans, Vander Linden. Length 1¼ inch; exp. wings 1½ inch. Locality, Pennance Heath, &c.

A. sanguinea, Step. Length 1¾ inch; exp. wings 2 inches. Locality, Swanpool Lane and Heath, Pennance, &c. During the summer of 1810, I found this species extremely abundant in the neighbourhood of Modbury, in Devonshire.

Genus—LESTES, Leach.

Wings narrow, thin, membranaceous, half expanded during repose; stigma large, oblong, quadrate; areolets pentagonal: abdomen slender, nearly linear, slightly dilated at the apex: male armed with curved appendages, female with simple ones.

L. viridis, Leach. Length 1¾ inch; exp. wings 2¼ inches. Locality, near Pengerrick, Budock Bottom, road, &c.

Genus—CALEPTERYX, Leach.

Head very broad, tumid in front, pilose; eyes large, globose; thorax large, with a strong dorsal ridge; wings coloured, broadish, coriaceous; stigma, in the female, white; male, none; areolets numerous; abdomen long, cylindrical, linear; anal appendage, in the male, curved.

C. virgo, Steph.

——— *Var. a.* Male and female, wings brownish.

——— *Var. b.* Male, wings dark indigo blue; apex brownish.

——— *Var. c.* Female, anterior wings light yellowish green; posterior brownish; stigma white.

College Wood, Trigoniggy, Nansgatha, &c.

C. Ludoviciana, Leach.

——————— *Var. a.* Male, wings deep blue-black.

——————— *Var. b.* Male and female, wings brown; the latter with a white stigmata.

Locality, College Wood, &c.

Family—LIBELLULIDÆ, Leach.

Head hemispherical; ocelli arranged in a line, or a triangle, on a vesicle; eyes very large, contiguous, sometimes remote; wings equal—during repose placed horizontally; abdomen cylindrical, depressed or clavate, furnished at the apex with hooks or peculiar appendages; tarsi three-jointed; claws toothed.

Genus—ÆSHNA, Fabricius.

Head semi-globose, prominent in front, vesicular; eyes contiguous; ocelli in a line, upon a small vesicle; labium with the middle lobe transverse; ovate-quadrate, tumid, divided, by a longitudinal impression, into two parts, apex emarginate; lateral lobes not encircling the central one, furnished with a moveable acuminated process, which rests on the upper edge of the inner lobe; labrium tumid, notched; mandibles toothed; wings large, obtusely rounded at apex, the inner margin of the posterior pair produced into a more or less acute angle in the male, but rounded in the female; stigma oblong; abdomen elongate-cylindrical, with the apex in the male furnished with three appendages, of variable form—in the female two, lanceolate.

E. grandis, Step. Length $2\frac{3}{4}$ inches; exp. wings $3\frac{3}{4}$ inches. Locality, Penmear Marsh, Trescobeas, &c.

E. maculatissima, Step. Length $2\frac{3}{4}$ inches; exp. wings $3\frac{3}{4}$ inches. Locality, Mylor, College Wood, &c.

E. vernalis. V. Linden. Length $2\frac{1}{8}$ inches; exp. wings 3 inches. Locality, Trefusis and College Wood.

Genus—CORDULEGASTER, Leach.

Head semi-globose; forehead tumid, pilose; eyes contiguous; ocelli placed in a curved transverse line, in a depression; middle lobe of the labium flat, rounded-quadrate, with a faint longitudinal ridge, the edge with a deep notch, the lobes with an acute tooth; lateral lobes moderate, accuminated at apex, furnished with a long moveable process; labrium tumid, with a deep marginal notch; mandibles acutely dentate; body pilose; abdomen *glabrous*, elongate, narrow, clavate; apex, in the male, with four short acute appendages—in the female, two very long ones: wings rather short, narrowish; inner margin of posterior pair obtusely angulated in the male, rounded in the female.

C. annulatus, Step. Length 3 inches; exp. of wings 3¾ inches. Trigoniggy, College and Trefusis Woods, &c.

GENUS—LIBELLULA, AUCTORUM.

Head large, semi-globose; forehead vesicular, pilose; eyes contiguous; oscilli three, placed in a triangle, on a distinct vesicle; labium tumid, the middle lobe small, transverse, semicircular, faintly produced in the middle; lateral lobes very large, transverse-quadrate, truncate at the apex, semi-globose; thorax large, pilose; wings large, posterior pair rounded on the inner margin of both sexes; stigma oblong; abdomen more or less depressed, never clavate; anal appendages moderate, short.

L. depressa, Linn. Length 1 inch 8 lines; exp. wings 2¾ inches. Locality, College Wood, Trigoniggy, &c.

L. coerulescens, Fabricius. Length 1⅝ inch; exp. wings 2¾ inches. Locality, Trigoniggy, Tregenver, and Budock Bottom.

L. vulgata, Linn. Length 1⅝ inch; exp. wings 2¼ inches. Locality, Trigoniggy Marsh, Budock Bottom, Nangatha, &c.

Addenda to Falmouth Fauna.

By W. P. COCKS.

1862.

Anobium striatum, Oliv. This insignificant little creature (not more than 1½ line in length,) is a great destroyer of wood, paper, books, prints, drawings, &c. Common in and out of the house. *M. Peignot* mentions an instance where, in a public library but little frequented, 27 folio volumes were perforated in a straight line by the larvæ of this insect in such a manner that, passing a string through the perfectly round hole made by it, these 27 volumes could be raised at once. This beetle is the cause of occasional alarm to ignorant persons, from the noise which it makes. *M. Latreille* states, the male and female, at the period of pairing, strike many times successively and rapidly, with their jaws, the object upon which they are stationed, and mutually answer each other's signal. Hence the insect has acquired the vulgar name *death-watch*.

"The solemn death-watch click'd the hour she died."—*Gray*.

———"A wood worm,
That lies in old wood, like a hare in her form,
With teeth, or with claws, it will bite, it will scratch,
And chambermaids christen this worm a *death-watch*:
Because, like a watch, it always cries click.
Then woe be to those in the house that are sick!
For, sure as a gun, they will give up the ghost,
If the maggot cries click when it scratches the post.
But a kettle of scalding hot water injected,
Infallibly cures the timber infected:
The omen is broken, the danger is over,
The maggot will die, and the sick will recover."—*Dean Swift*.

Acarus farinæ, Has. Flour mite. In flour. Common.

——————— Meal mite. In oatmeal. Common.

——————— In rice, whole and ground. Common.

Acarus sacchari, Has. This disagreeable looking mite is to be found in nearly all the ordinary brown sugars offered for sale.

Aphrophora spumaria, Ger. The larva and pupa protected by their "frothy tent" on the plants in the garden, &c. Very common.

Limnoria terebrans, Leach, and *Chelura terebrans*, Allman. In a piece of submerged oak from the harbour. These pigmy timber-eating insects, in point of rapidity of execution, seem to surpass all their European brethren (teredines, &c.,) and in many cases are productive of more serious injury than any of them, since they attack the wood-work of piers, jetties, &c., constructed in salt water, and so effectually as to threaten a rapid destruction of those in which they are established. No species of wood is exempt from their ravages—which is reduced to a state resembling honeycomb. *Dr. Harvey* observes:—"Not so big as a grain of rice, but as active as the mother of mischief herself, and as untiring."

Coccus vitis, Schr. The trunks and branches of the vines in the greenhouse covered by these parasites.

Lampyris noctiluca, Linn. Female specimens. Mylor.

> "When, looking eagerly around,
> He spied far off, upon the ground,
> A something shining in the dark,
> And knew the *glow-worm* by his spark."—*Cowper.*

Julus fragariarum, Lam. Broods of young (centipedes) in the pulp of the strawberries from Mylor this season.

Podura aquatica, Linn. Several patches of them on the surface of the water in the "garden-butt."

Numenius arquata, Tem. Six birds left Penryn river about six o'clock a.m., and crossed the harbour in a north-easterly direction.

Lithobius forcipatus, Leach. House, greenhouse, and garden. Rather plentiful.

Elater lineatus, Oliv. Grass-plat in garden, &c. The larva of this beetle (wire-worm.) It is stated that if the wheat crops in this country likely to be affected by the wire-worm be estimated at 1,200,000 acres, this will give 60,000 acres annually destroyed by the insect; which, replanted at one bushel per acre, will require 60,000 bushels of seed, which, at 8s. per bushel, are worth £24,000, besides labour.

Curculio granaria, Linn. The corn weevil is among the most injurious insects with which corn is infested. It has been calculated that the descendants of one female may amount in a single season to 33,600 individuals. Common.

Musca domestica, Linn. Common house fly. Fixed to a square of glass in bedroom window, by the fungus,—*Botytis Bassiana.*

Tinea pellionella, Linn. The caterpillar of this little moth is a determined enemy to valuable furs; it shaves the hair from the skin as neatly and closely as if a razor had been used. In the house. Common.

Tinea tapetzella, Linn. Common in the house. The caterpillar of this moth is a great destroyer of woollen clothes, bed furniture, window curtains, &c. We know this from experience.

Dermestes murinus, Linn. Pitchy black, mottled with ashy hairs. 3¼ lines in length. Found in the pantry.

Note.—The *Derm. vulpinus*, Linn., a species which, says *Mr. Westwood*, is common throughout Europe and America, was found alive in London some years ago, and was so injurious in the large skin warehouses, that a reward of £20,000 was offered for an available remedy, without, however, any being discovered.

A multitude of sprats (*clupea sprattus*, Linn.,) appeared at Swanpool in the month of August, and thousands were taken in baskets, &c., by men and boys.

Pinna ingens, Mont. From deep water, about twelve miles from Falmouth Harbour. Not common. The byssus by which the shell is fixed to a solid body is long, fine, silky, and very abundant. *Rondelet* observes these threads are as fine, compared with those of the muscle, as the finest flax compared with tow; and *Reamure* says they are nearly as fine and beautiful as silk from the silk-worm: hence the common name given to the animal, "the silk-worm of the sea." The fibres or threads are composed of glutinous matter, cast in a mould, where they harden and acquire a certain consistence before they are employed. *Poli* asserts that the byssus in *silk-producing fish* is of the same texture as hair, and that at the extremity it is furnished with suckers, by which it adheres firmly to the rocks and other bodies. The thread is so fine, that a pair of stockings made of it can be easily contained in a snuff-box of an ordinary size. In the year 1745, a pair of gloves of this material was presented to *Pope Benedict XIV.*, which, notwithstanding their extreme fineness, protected the part both from cold or heat. A robe composed of the thread was a gift of the Roman Emperor to the Satraps (a governor of a district,) of Armenia. A writer in the *Gentleman's Magazine*, in 1782, says:—"The ancients had a manufacture of silk, and about forty years ago it was revived at Tarento and Regio, in the kingdom of Naples. It consists of a strong brown silk, belonging to some sort of shell, of which they make caps, gloves, stockings, waistcoats, &c., warmer than the woollen stuffs, and brighter than common silk."

Note.—In the Great Exhibition of 1851, a variety of products manufactured from the *pinna silk* were exhibited; and Dr. Lankester states that a purse and other articles, formed from this fibre, are exhibited in the animal product collection of the museum at South Kensington.

This gigantic mollusc is exposed to the attack of many enemies—especially of the cuttle-fish, which is its deadly foe; but to the vigilance of the little crab *(pinnotheres veterum,)* which takes refuge in the shell, the pinna is warned of the approach of an enemy, &c., and *Aristotle* says it is also a faithful purveyor of food.

> The pinna and the crab together dwell,
> For mutual succour, in a common shell.
> They both to gain a livelihood combine;
> That takes the prey, when this has given the sign.
> From hence this crab, above his fellows fam'd,
> By ancient Greeks was pinnoteres named.—*Oppian.*

Pearls are sometimes found in the pinna.

"O Lord, how manifold are Thy works! in wisdom hast Thou made them all: the earth is full of Thy riches."—*Psalm* civ., 24.

Remarks on an improved form of Duty Paper.

BY W. MORSHEAD, JUN.

The high duty performed by the Cornish pumping engines may fairly be traced to the system of publishing the duty of the different engines in the monthly reports; hence, as the consideration of the best form of report to be adopted is a matter of considerable importance, I trust that no apology will be necessary for a few hasty remarks on the subject. The form of duty paper now published, however useful it may have been, and however valuable the information it contains, nevertheless appears defective in the following respects:—

1st.—No classification of the engines is adopted, as to those from which a high duty might be expected, and those which, from their small size, the time they have been at work, or other reasons, could not be expected to compete with them. Thus we find, perhaps, an 80-inch cylinder engine, working expansively, and with every care taken to prevent loss of heat and save fuel, placed side by side with a small horizontal engine, working with a slide valve, and having the steam pipes and cylinder exposed to the atmosphere.

2nd.—No notice is taken of the quality of the coal used, the duty being computed simply from the *quantity* of coal consumed, without any reference to its capacity for producing heat, although it is well known that the evaporative power of the different coals employed in Cornwall varies considerably.

3rd.—In computing the duty, no allowance is made for the friction of any flat rods that may be attached to the engine, or for that of any angle bobs or rods in a diagonal shaft, or for any of the rods not being properly balanced, &c. It is true that a notice of the flat rods, &c., attached to each engine is inserted in the duty paper, but no corresponding addition is made to the duty, so that an engine which draws from one shaft perpendicularly (in which case the friction and consequent loss of power is, of course, a minimum,) is put down as doing as much work as another, which lifts an equal weight of water, perhaps from three or four different shafts, each, it may be, 100 or 150 fms. distant from the engine, though, from the friction and inertia of the flat rods to be overcome, the work done in the latter case is really much greater than in the former.

4th.—No notice of the *expansion* is inserted in the duty paper; so that it is impossible to find out, merely from an inspection of the duty paper, how far the high duty of one engine may be due to the use of high steam, cut off at an early period of the stroke, or the lower duty of another to some weak part in the engine or pitwork, which necessitates the employment of lower steam, continued through a greater portion of the stroke, and a consequently slower motion.

5th.—The addition of a column, containing the vacuum attained to in each engine, would be a valuable improvement.

I beg, therefore, to submit to you a draft of a duty paper which, though far from perfect, will, I think, be found an improvement on that now published. In the first place, the engines are classed under two headings, A and B; the first comprising those engines from which a good duty might be expected, and the second those which, from the time they have been at work, or other reasons, could not be expected to compete with them. Every engine being thus placed with those of its own class, a fairer estimate of its relative, rather than its absolute duty, can be formed. It will, of course, happen that it may be doubtful sometimes under which heading an engine should be classed. This must be left, in a great measure, to the judgment of the reporter. An additional column contains a notice of the quality of the coal used in every case, as far as it can be ascertained. This, it appears to me, is absolutely necessary, in order to arrive at anything like a fair estimate of the comparative duty of different engines, or of the same engines at different times. Thirdly, instead of reckoning the load upon the piston simply by the weight of water lifted, it is taken also by an indicator diagram; the difference between the load thus ascertained and the weight of water actually lifted, that is, the loss of power by the friction and inertia of the pitwork, &c., being placed in a separate column. An indicator would also show whether the engine was working properly or not. Fourthly, the part of the stroke at which the steam is cut off is given; and lastly, the vacuum.

A duty paper on this plan would be very little more expensive than that now published; while, besides giving a fairer comparison of the duty of the different engines, it would form a valuable paper of reference, and furnish useful data for the engineer. Its adoption would induce more engineers and mine agents to have their engines reported, and the extra sale of the papers would more than compensate the trifling extra expense. I do not, however, mean to submit it as anything like perfect, but only as an improvement on that now published.

NES.

Load on square inch, as per water lifted.	Difference, showing power absorbed by the pitwork.
8·0	
10·8	
16·1	
TY CANNOT	
20·1	
12·8	
4·7	

TABLE No. 1.

From Registers kept by M. P. Moyle, Esq.

MONTHLY MEANS OF THE BAROMETER. Cistern 106 feet above mean sea level.

1862. Month.	Mean pressure corrected to 32° Fahr. Greenwich Time. 9 a.m.	3 p.m.	9 p.m.	Mean of monthly means.	Mean Correction for Diurnal range.	True mean.	Mean force of vapour.	Mean pressure of dry air.	Mean range of means.	Mean daily range.	Corrected absolute maximum observed.	Day.	Corrected absolute minimum observed.	Day.	Extreme range for the month.	Greatest range from 9 a.m. to 9 p.m.	Day.	Greatest range in any two consecutive 24 hours.	Between which days it occurred.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.		in.		in.	in.		in.	
January	29·809	29·800	29·825	29·812	·004	29·808	·297	29·511	·120	·114	30·353	2	29·126	23	1·227	·346	11	+ ·574	24 & 25
February	29·950	29·930	29·948	29·945	3	29·942	·284	29·658	·155	·112	30·620	9	29·086	18	1·534	·363	8	+ ·505	7 & 8
March	29·555	29·548	29·566	29·563	7	29·556	·320	29·236	·176	·124	30·048	14	29·072	28	·976	·426	9	+ ·878	9 & 10
April	29·935	29·941	29·956	29·944	4	29·940	·340	29·600	·102	·76	30·331	13	29·458	2	·873	·274	3	+ ·483	3 & 4
May	29·833	29·843	29·849	29.843	2	29·841	·366	29·475	·135	·85	30·192	2	29·459	30	·733	·275	3	+ ·467	30 & 31
June	29·914	29·933	29·947	29·935	3	29·932	·398	29·534	·111	·76	30·159	25	29·440	6	·719	·178	4	— ·518	4 & 5
July	29·899	29·898	29·911	29·905	2	29·903	·449	29·454	·113	·70	30·262	21	29·286	5	·976	·262	11	+ ·475	7 & 8
August	29·903	29·904	29·911	29·906	4	29·902	·459	29·443	·98	·69	30·156	24	29·408	7	·748	·284	4	— ·440	3 & 4
September	29·951	29·940	29·918	29·948	4	29·944	·449	29·495	·98	·70	30·331	13	29·623	29	·708	·222	13	— ·371	12 & 13
October	29·851	29·847	29·862	29·850	6	29·844	·389	29·455	·159	·114	30·400	4	29·090	19	1·310	·585	19	— ·644	18 & 19
November	29·889	29·868	29·892	29·885	4	29·881	·270	29·611	·130	·97	30·349	17	29·413	10	·936	·332	11	+ ·502	8 & 9
December	30·005	30·003	30·017	30·007	3	30·004	·324	29·680	·171	·105	30·434	25	29·238	2	1·196	·336	20	— ·652	28 & 29
Means	29·874	29·871	29·891	29·878	·004	29·874	·362	29·512	·131	·093	30·303		29·308		·995	·323		·542	

REMARKS.—0·121 in. should be added to all the readings of the Barometer for its elevation of 106 feet above mean sea level. The Barometer is a standard, having a bore of 0·6 in. in diameter, with glass cistern 3 in. in diameter, whereby the ivory point of the brass scale can by sight be brought to a tangent with the surface of the mercury at each observation; the open end of the tube has a ring of platina, as recommended by Daniell, for the perfect exclusion of atmospheric air—the tube was filled in vacuo with mercury of the specific gravity of 13·5 —and Mr. Glaisher's corrections have been applied to every period of observation taken from the Philosophical Transactions, Part 1, for 1848.

No. 2

Mo.	9 a.m. Dry.	9 a.m. Wet.	3 p.m. Dry.	3 p.m. Wet.	9 p.m. Dry.	9 p.m. Wet.	Mean of dry Therm.	Correction for diurnal range	True mean of dry Therm.	Mean of wet Therm.	Correction for diurnal range	True mean of wet Therm.	Wet Therm. below dry.	Mean temp. of Dew point.	Dew pt. below dry Therm.	Greatest range dry Therm. 9 a.m. to 9 p.m.	Mean of all the maxima.	Mean of all the minima.	Approximate mean temp.	Correction for the month.	True mean temperature.	Mean range.	Maximum observed.	Day.	Minimum observed.	Day.	Mean.	Range.	Maximum in sun.	Minimum on grass.	Mean.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°		°		°	°	°	°	°
Jan..	45·9	44·5	47·8	46·0	46·1	44·8	46·6	·4	46·2	45·1	·3	44·8	1·4	43·3	2·9	9·0	49·8	41·6	45·7	·2	45·5	8·2	53·0	often.	33·0	thrice.	43·0	20·0	71	28	49·5
Feb..	45·4	44·0	48·1	45·9	44·8	43·1	46·1	·6	45·5	44·3	·4	43·9	1·6	42·1	3·4	9·0	49·9	41·4	45·7	·4	45·3	8·5	60·0	17	29·0	8	44·5	31·0	74	26	50·0
Mar..	48·2	47·	50·7	48·6	47·6	46·5	48·8	1·2	47·6	47·3	·7	46·6	1·0	45·5	2·1	8·0	52·7	42·8	47·8	1·0	46·8	9·9	60·0	29	30·0	3	45·0	30·0	78	24	51·0
April	52·2	49·9	55·6	52·2	51·1	49·3	52·9	2·2	50·7	50·4	1·4	49·0	1·7	47·3	3·4	10·0	57·3	45·9	51·6	1·5	50·1	11·3	67·0	28	33·0	13	50·0	34·0	86	30	58·0
May.	56·9	54·3	59·6	55·8	54·6	52·6	57·1	2·3	54·8	54·2	2·1	52·1	2·7	49·4	5·4	11·0	62·2	48·7	55·4	1·7	53·7	13·5	67·0	thrice.	40·0	13	53·5	27·0	88	31	59·5
June	58·9	55·7	61·5	57·1	56·7	54·4	59·0	3·0	56·0	55·7	2·0	53·7	2·3	51·9	4·1	7·0	65·4	50·2	57·8	1·8	56·0	15·2	70·0	1	44·0	3	57·0	26·0	90	43	66·5
July.	61·0	58·2	63·6	57·8	59·1	57·0	61·2	2·2	59·0	58·3	1·3	57·0	2·0	55·4	3·6	9·0	65·5	52·3	58·9	1·9	57·0	13·2	71·0	26	45·0	21	58·0	26·0	110	61	85·5
Aug.	62·1	59·3	64·8	60·8	60·1	54·6	62·3	2·1	60·2	59·3	1·4	57·9	2·3	56·1	4·1	8·0	68·1	53·7	60·9	1·7	59·2	14·4	75·0	29	45·0	2	60·0	20·0	111	43	77·0
Sept.	59·8	57·6	63·0	59·7	58·8	56·9	60·5	1·7	58·8	58·1	1·2	56·9	1·9	55·4	3·4	9·0	65·6	52·6	59·1	1·3	57·8	13·0	71·0	16	44·0	30	57·5	27·0	102	40	71·0
Oct..	55·5	53·7	57·3	54·5	54·7	53·0	55·8	·5	55·3	53·7	·7	53·0	2·3	51·2	4·1	8·0	59·7	49·4	54·6	1·0	53·6	10·3	67·0	10	35·0	29	51·0	32·0	66	32	59·0
Nov.	43·7	42·2	48·0	45·5	43·5	42·4	45·1	·5	44·6	43·2	·5	42·7	1·9	40·6	4·0	11·0	51·0	37·8	44·4	·4	44·0	13·2	58·0	1	31·0	21	44·5	27·0	76	26	51.0
Dec..	48·7	47·5	49·9	48·5	48·6	46·9	49·0	·2	48·8	47·6	·2	47·4	1·4	45·9	2·9	9·0	52·4	41·4	48·3	·0	48·3	8·1	56·0	6	35·0	13	45·5	21·0	66	31	48·5
Mns.	53·2	51·1	55·8	52·7	52·1	50·1	53·7	1·4	52·3	51·4	1·0	50 4	1·9	48·7	3·6	9·0	58·3	46·5	52·5	1·1	51·4	11·5	64·6		37·0		50·1		86·5	34·6	00·5

Remarks.—The Registering Thermometers were made by Negretti and Zambra, and have been corrected by Mr. Glaisher. The Dry and Wet Thermometers were made by myself, and are found to be coincident, very nearly, with a standard Thermometer by Dollond; where there has been any discrepancy, the difference has been correctly noticed and allowed for.

TABLE No. 3.

1862. WINDS.

MONTH.	N.			N.E.			E.			S.E.			S.			S.W.			W.			N.W.			AVERAGE FORCE—0 to 6.				RELATIVE PROPORTION.				No. of days
	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.	Mean.	N.	E.	S.	W.	
Jan.....	3	2	2	2	2	2	3	3	2	5	4	3	2	2	2	5	9	11	7	5	4	4	4	5	2·4	2·5	2·1	2·3	5	6	8	12	31
Feb.....	2	4	3	4	2	3	8	9	7	2	3	4	2	4	4	5	3	2	2	3	4	3	0	1	2·4	2·5	2·0	2·3	5	11	7	5	28
March..	2	2	2	1	0	0	12	10	10	3	3	2	5	3	3	4	7	7	1	4	5	3	2	2	2·4	2·6	2·0	2·3	3	12	9	7	31
April...	3	3	4	4	1	1	4	5	4	1	1	1	1	3	1	14	10	8	1	6	8	2	1	3	2·4	2·5	1·8	2·2	5	5	8	12	30
May....	4	3	3	0	0	0	3	3	3	1	2	1	3	1	0	9	10	10	8	7	9	3	5	4	2·5	2·5	1·8	2·2	6	4	6	15	31
June ...	3	1	1	0	0	0	1	1	0	1	1	1	2	2	1	7	9	6	4	4	7	12	12	14	2·3	2·5	2·0	2·3	8	2	5	15	30
July....	1	0	1	0	0	0	0	0	1	0	1	0	5	2	1	10	15	10	6	9	12	9	4	6	2·3	2·5	1·8	2·2	4	0	9	18	31
August	1	0	2	2	0	1	2	2	2	1	1	0	2	2	4	8	11	5	6	4	8	9	11	8	2·0	2·2	1·4	1·8	6	3	8	14	31
Sept....	5	3	5	3	2	2	6	7	6	1	0	1	2	4	4	7	9	6	3	1	4	3	4	2	3·0	2·4	1·6	1·9	7	8	6	9	30
Oct.....	3	3	3	2	0	1	4	3	4	1	1	0	4	4	6	5	7	6	9	9	8	3	4	3	2·2	2·8	2·0	2·3	5	5	8	13	31
Nov....	10	6	7	5	5	5	3	4	4	0	0	0	4	3	4	2	5	3	2	4	1	4	3	6	1·6	2·1	1·5	1·7	12	7	6	5	30
Dec.....	4	3	5	0	0	0	0	0	0	3	3	3	4	2	2	5	8	7	9	8	10	6	7	4	2·6	2·1	2·1	2·8	7	2	7	15	31
Sums...	41	30	38	23	12	15	46	47	43	19	20	16	36	32	32	81	103	81	58	64	80	61	57	58	281	292	221	263	73	65	87	140	365
Means.	36·3			17·0			45·3			18·3			33·3			88·3			67·3			58·7			2·3	2·4	1·9	2·2	6·1	5·4	7·2	11·7	

TABLE No. 4.

1862.	WEATHER.																	
MONTH.	Average Cloudiness. = 0 to 10.				No. of dry days.	No. of wet days.	Amount of rain in cubic inches.	Mean weight of vapour in a cubic foot of air.	Mn. addl. weight requir'd for saturation of the air.	Mean force of vapour.	Mean degree of humidity saturation = 1·000.	Mean weight of a cubic foot of air at its respective pressure.	Mn. amt. of water in a vertl. col. of the atmosphere.	Moffat's Ozonometer.			Days on which more than a quarter of a cubic inch fell.	REMARKS.
	9 a.m.	3 p.m.	9 p.m.	Means.										9 a.m.	9 p.m.	Means.		
							in.	grs.	grs.	deg.	deg.	grs.	grs.					
Jan.....	7·9	7·2	7·3	7·4	8	23	3·85	3·31	0·47	·297	·875	541·46	4·11	4·5	3·5	4·0	7, 9, 11, 16, 21, 23, 24, 30.	Au. Saturday, 30; hail, 14, 22; lunar halo, 14; thund & light 23; fog, 31; gale, 11, 12, 21, 23, 24.
Feb.....	7·6	6·7	6·7	7·3	15	13	1·11	3·29	·41	·284	·888	544·64	3·93	3·4	2·5	2·9	10, 21.	Fog, 3, 4; honeysuckle in leaf 10; gale, 15, 16; peach in bloom, 21.
March.	7·9	6·8	8·0	7·5	8	23	4·81	3·69	·27	·320	·930	535·14	4·42	4·2	3·1	3·4	5, 8, 10, 13, 20, 22.	Hail, 3, 4; gale, 5, 6; fog, 11, 16, 23, 25, 27; hawthorn in leaf, 17; cuckoo, 24; pear and plum in bloom, 28.
April...	6·8	5·9	6·3	6·3	15	15	2·63	3·90	·48	·340	·888	538·70	4·70	4·0	2·9	3·1	1, 2, 14, 24.	Fog, 1, 6, 7; hail, 13; gale, 29; apple in bl. 9; 1st swallow, 18; lilac, 24; laburnum, 26.
May....	5·8	5·6	5·0	5·4	15	16	2·33	5·0	·79	·366	·841	532·25	5·06	3·5	2·8	3·1	27, 30.	Hail, 20; fog, 27, 28; gale, 3.
June...	6·2	5·8	5·6	5·9	15	15	3·10	4·52	·56	·398	·871	532·58	5·50	3·3	2·6	3·0	5, 6, 9, 14.	Fog, 3; wheat in ear, 11; in bloom, 19.
July....	6·1	5·8	6·9	6·2	11	20	2·90	5·04	·55	·449	·887	528·41	6·22	3·1	2·2	2·4	4, 11, 17, 22.	
August	5·8	5·2	5·2	5·4	19	12	1·83	5·16	·75	·459	·873	527·08	6·36	2·6	1·9	2·3	6.	Wheat cut, 2; barley and oats, 10; solar halo, 24; fog, 20; thunder, 31.
Sept....	6·2	5·1	6·2	5·8	13	17	4·13	5·05	·56	·449	·899	529·32	6·22	3·2	2·0	2·6	2, 13, 23, 24, 26, 27.	Lightning, 2; fog, 9, 16, 28; thunder, 30.
Oct.....	7·1	7·0	6·3	6·8	9	22	5·07	4·42	·65	·389	·870	531·43	5·38	4·7	3·5	4·1	13, 17, 18, 19, 20, 22, 25.	Woodcock, 8; fieldfare, 25; last swallow, 22; hail, 15, 16, 20; thun. and light., 20; thunder, 21, 2.10; gale, 16, 17, 19, 20, 25.
Nov....	4·1	5·2	5·4	4·9	16	14	3·51	3·12	·47	·270	·870	544·63	3·73	2·4	1·7	2·0	3, 9, 13, 28.	Hail, 10, 11.
Dec.....	7·5	7·8	6·7	7·3	12	19	3·16	3·73	·38	·324	·907	541·88	4·48	5·3	4·0	4·6	4, 9, 22.	Fog, 6, 26, 29; hail, 20; gale, 5, 6, 12, 20, 28.
Means.	6·6	6·1	6·3	6·3	156	209	38·43	4·18	·53	·362	·883	535·63	5·01	3·7	2·7	3·2		

REMARKS. The Rain Gauge is on Howard's principle, 5 feet from the surface of the ground, and perfectly free from any local effects. Wet days include fog and snow. The dew point, weight of vapour in a cubic foot of air, humidity, &c., are deduced from the tables in the Greenwich Meteorological Observations for 1847. The corrections for the diurnal range [illegible] from Glaisher's tables [illegible]

Abstract of Meteorological Journal for Bodmin, in 1862.

Lat. 50° 29′ N., Long. 4° 40′ W. Height of Rain Guage above the ground 4 feet; above the sea, 330 feet.

BY LIEUT. J. LIDDELL, R.N.

Month.	Max. of Bar.	Min. of Bar.	Max. of Ther.	Min. of Ther.	Mon. aver. tem. 1862.	Bodmin mon. aver. of tem.	Days with rain.	Bodmin average of rainy days	Greatest fall in one day.	Monthly rain fall, 1862.	Bodmin av. of mon. rain fall.	Month.
	ins.	ins.	deg.	deg.	deg.	deg.			inches.	ins.	ins.	
Jan ...	30·18	28·87	53	30	44½	42	24	22	18th 0·81	5·52	5·16	January.
Feb ...	30·38	29·02	54	25	43	41½	14	16	22nd 0·59	1·86	2·58	February
March	29·82	28·80	56	31	45½	45	24	17	6th 1·06	5·63	3·55	March.
April.	30·16	29·20	60	27	50½	48½	20	15½	2nd 0·50	2·65	3·00	April.
May...	29·99	29·25	65	45	56½	55½	17	14½	9th 0·66	2·73	2·87	May.
June..	29·98	28·90	65	46	56	59	20	16½	11th 0·90	4·59	3·56	June.
July ..	30·10	29·10	69	40	58½	61½	18	16½	12th 0·53	3·34	3·32	July.
Aug...	30·02	29·41	68	49	59½	61	15	17	7th 0·86	2·38	3·18	August.
Sept...	30·18	29·40	64	48	58	59	17	14½	28th 0·60	4·45	3·19	Sept.
Oct....	30·28	29·15	62	35	55	53½	25	21	20th 0·99	6·88	5·13	October.
Nov...	30·13	29·19	56	30	42½	43½	15	19½	10th 0·42	2·13	4·45	Novem.
Dec ...	30·17	29·11	56	34	47	43	28	21½	5th 0·70	5·20	4·86	Decem.
					51	51	237	211½		47·36	44·85	

Total rain fall in 1862, 47·36 inches.

Bodmin average rain fall, 44·85 inches.

Days with rain, 237.

Bodmin average of rainy days, 211½.

Greatest fall in one day, March 6, 1·06 inches.

Average fall of rain per diem, 0·1297 in.

Extremes since 1849 { **Greatest fall in 1852, 59·64 inches.** / **Least fall in 1854, 33·15 inches.**

Average temperature in 1862, 51°.

Bodmin average, 51°.

Treasurer in Account with the Royal Cornwall Polytechnic Society,
1862.

Dr.

Receipts.

	£	s.	d.	£	s.	d.
Balance from 1861...	6	6	11			
Petty cash	3	6	4			
				9	13	3
Royal Subscriptions				10	0	0
Members Subscriptions	130	1	0			
New ditto	14	16	0			
				144	17	0
Arrears of ditto				5	12	0
Donation from Mr. Baxendale				5	0	0
Subscriptions and Donations from Mines:						
Wheal Seton.........	5	5	0			
South Wh. Frances	5	5	0			
Wh. Clifford Amalgamated............	5	0	0			
Par Consols	3	0	0			
Dolcoath	3	0	0			
Wheal Basset	2	2	0			
East Wh. Basset ...	2	2	0			
				25	14	0
Receipts at Exhibition :—						
Admissions	81	12	6			
Catalogues	8	11	3			
Paid for Competition..................	1	4	0			
				91	7	9
Hire of Hall for County Court				25	4	0
Ditto miscellaneous				99	9	3
Rent of Tenements				15	8	4
				£432	5	7

Cr.

Disbursements.

	£	s.	d.	£	s.	d.
General Expenses.						
Petty Cash, as per book				57	10	1
Gas Company........................				20	7	2
Mr. Johns, for proportion of Repairs, Insurance, &c.				11	0	0
W. H. Dunstan, on account for 1861-2				11	0	0
Roskilly, for new Blinds, repairs of Chairs, &c.				5	15	0
Advertisements........................				3	5	2
Interest on Loan				12	11	6
Frame for Sir Charles Lemon's Portrait				4	10	0
Heard and Son, for Reports ...				20	8	8
Secretary.............................				30	0	0
Printing, Stationery, &c..........				19	10	8
Transferred to Loan Fund				20	0	0
Returned to Mr. Morris, on Let of Hall........................				0	10	0
Stamped Cheques 2s., Bullocke £1 17s..............................				1	19	0
Exhibition Expenses.						
Paid Prizes in Cash				67	10	0
Medals..................................				12	1	4
Carriage of Goods to and from Exhibition, collecting and packing Pictures at Plymouth, other places, and in the neighbourhood				20	17	3
Roberts, for Men, at Exhibition, Materials, &c.				14	4	1
Lectures at Exhibition, Messrs. Pengelly and Hearder				18	10	0
Assistance at Exhibition.........				4	15	0
Water at ditto				2	0	0
Rickard, extra money				2	10	0
Policemen				1	10	0
Printing Catalogues, &c., Mrs. Lake................................				10	18	8
Refreshments at Exhibition (Judges)				4	4	11
Balance in Treasurer's hands.................	2	0	10			
Ditto, petty cash......	2	16	3			
				4	17	1
				£432	5	7

Ed. B. TWEEDY, Treasurer.

Audited and compared with Vouchers 2nd February, 1863.

ROBERT R. BROAD, } Auditors.
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PENRYN.

	£	s.	d.
Coombes, J.	0	5	0
* Enys, J. S., F.G.S., *Enys*	2	0	0
Gill, T.	0	5	0
Gloyne, R.	0	5	0
Hosken, R.	0	10	6
Hosken, W.	0	5	0
Jenkins, G. A.	0	5	0
* Lemon, Sir Charles, Bart., F.R.S., *Carclew, President*	2	2	0
Manser, W.	0	5	0
Read, J. B.	1	0	0
Rundle, J.	0	5	0
Sara, N.	0	10	0
Saunders, Rev. C. D.	0	5	0
Sowell, R.	0	5	0
Mead, J.	0	5	0
Reed, T. W., *Trevissome*	0	10	0
* Rogers, T., *Hon. Sec.*	0	5	0
Rogers, T., jun.	0	5	0
Trenery, George	0	5	0

PENZANCE.

	£	s.	d.
* Bevan, C. D., *Boskenna, Vice-President*	1	1	0
* Bolitho, T. S.	1	0	0
Carne, Miss	1	1	0
* Couch, R. Q.	0	5	0
Davy, R. V.	0	5	0
Davy, Humphry	0	5	0
* Flamank, James	0	5	0
Henwood, W. J., F.R.S., F.G.S.	0	5	0
Roscorla, John	0	5	0
* Rodd, E. H.	0	10	0
* Smith, Augustus, M.P.. *Scilly*	2	2	0
* St. Aubyn, J., M.P.	1	0	0
Vibert, J. P.	0	10	0

REDRUTH.

	£	s.	d.
* Basset, J. F., *Tehidy*	2	2	0
* Blee, Robert	0	10	0
Carnell, J.	0	5	0
* Davey, Stephen	1	1	0
* Davey, Richard, M.P., F.G.S.	1	1	0
* Garland, T., *Fairfield*	0	10	0
* Hocking, J., C.E.	0	5	0
* Loam, M.	0	10	0
* Magor, R. F.	1	0	0
* Reynolds, Charles, *Trevenson.*	0	10	0
* Richards, William	1	0	0
Symons, F., *St. Agnes*	0	5	0
Tweedy, R. M.	0	10	0

ST. AUSTELL.

	£	s.	d.
* Drake, Dr.	0	5	0
* Jenkins, Rev. D., *St. Goran*	0	5	0
* Tremayne, J., *Heligan, Vice-President*	2	2	0

TRURO.

	£	s.	d.
* Barham, C., M.D.	0	10	0
Baxter, Mrs. Richard	0	5	0
Bond, W. H.	0	10	0
Brune, Mrs. M. Prideaux, *Padstow*	1	0	0
* Carlyon, C., M.D.	1	0	0
Carlyon, Miss H.	0	5	0
Carter, R. H.	0	5	0
Champion, Mr.	0	10	0
Daubuz, Rev. J., *Killiow*	1	0	0
* Falmouth, Rt. Hon. Viscount, *Vice-President*	2	2	0
Gilbert, Hon. Mrs., *Trelissick*	1	0	0
* Gregor, G. W. F.	2	2	0
Gwatkin, Mrs.	1	0	0
* Hawkins, C. H., *Trewithen*	1	0	0
Heard, Edward	0	5	0
* Jago, James, M.D., *Oxon*	0	5	0
Jackson, Mrs. F. C.	0	5	0
Karkeek, P.	0	5	0
Netherton, J. R.	0	5	0
* Phillpotts, Rev. T., *Feock, Vice-President*	0	10	0
Polwhele, Colonel	0	10	0
* Roberts, Joseph	0	10	0
Smirke, E., *Vice-Warden of the Stannaries*	2	2	0
* Smith, P. P.	0	10	0
Stackhouse, Miss Emily	0	10	0
Stokes, H. S.	0	10	0
* Tweedy, Robert	0	10	0
Tweedy, Mrs. W. M.	0	10	0
Vivian, J. Ennis	1	0	0
* Willyams, H., *Carnanton*	1	0	0
Wotton, T. Dewen	0	5	0

List of Annual Subscribers.

SUBSCRIBERS RESIDENT OUT OF THE COUNTY.

LONDON.

* Baring, T.G., M.P., *Vice-President*	£1	1	0
Bunsen, E., *Abbey Lodge, Regent's Park*	1	0	0
W. Dymond, *New Square, Lincoln's Inn*	0	10	0
Fox, S. L., *Tottenham*	0	10	0
Fox, J. J., *Stoke Newington*	0	5	0
* Gurney, S., M.P., *Princes-gate, Kensington, Vice-President*	2	2	0
Hunt, Robert, F.R.S., *Vice-President*	0	10	0
Hunt, Mrs.	£0	10	0
Smyth, W. W., M.A., F.R.S.	1	0	0
Taylor, John, F.R.S., &c.	2	2	0
Taylor, John, jun., *Bayswater*	1	1	0
* Taylor, Rd., F.G.S., *Hon. Sec., Vice-President*	2	2	0
Trelawny, Sir J. S., M.P., 44, *Hertford-street, Mayfair*	1	1	0
Trestrail, Rev. F.	0	10	0
Vaughan, E. R. H., 15, *Southampton Buildings, Chancery Lane*	0	10	0
Woodhouse, Miss, *Hampton-wick, Kingston, Surrey*	0	5	0

PLYMOUTH AND DEVONPORT.

Balkwill, A. P.	£0	5	0
Boswarva, J.	0	5	0
Brewer, Julian C.	0	5	0
* Buller, Sir Anthony, *Pound*	1	1	0
Gatcombe, J.	0	5	0
Hancock, R., *Devonport*	0	5	0
Hearder, J. N.	0	5	0
Latimer, I.	£0	10	0
* Mount Edgcumbe, Right Hon. Earl of, *Vice-President*	2	2	0
Mitchell, T. H., *Eton Villa*	0	5	0
Ommaney, E.	0	5	0
Saunders, A.	0	5	0
Scott, Miss M. L., 10, *South Devon Place, Plymouth*	0	5	0

Bellows, J., *Gloucester*	£0	5	0
Jones, Milton, *ditto*	0	5	0
Pease, J. W., *Darlington*	0	5	0
Rundle, W. W., *Liverpool*	0	5	0
Robjohns, W., *Tavistock*	0	5	0
Savory, James, *Exeter*	0	5	0
Tangye, Brothers, *Birmingham.*	0	5	0
Trevithick, T., *Parys Mine, near Bangor, N.W.*	0	10	0
Tucket, Francis Fox, *Frenchay, Bristol*	1	0	0
Vivian, William, *Parys Mine, Bangor*	£1	10	0
Williams, W., *Topsham*	0	5	0
Fox, Theo., *Wales*	0	5	0
Fox, Miss G. C.	0	5	0
Hall, Mr. Sydney, *Sussex College, Oxford*	0	5	0
Johnson, Percival N., F.R.S., F.G.S., *Stoke House, Dartmouth*	0	10	0

List of Annual Subscribers.

SUBSCRIPTIONS AND DONATIONS FROM MINES.

Dolcoath, *per Capt. Thomas*	£3	0	0
Par Consols, *per Major Davis*	3	0	0
South Frances, *per R. R. Broad*	5	5	0
East Wheal Basset, *per W. Richards*	2	2	0
Wheal Basset, *per W. Richards*	2	2	0
Wheal Clifford Amalgamated, *per Williams and Son*	£5	0	0
Wheal Friendship, *per J. Matthews*	2	2	0
Wheal Seton, *per T. H. Tilly*	5	5	0

ROYAL CORNWALL POLYTECHNIC SOCIETY,

FOR THE ENCOURAGEMENT OF

Science, and the Fine and Industrial Arts.

INSTITUTED 1833.

Patroness:

HER MOST GRACIOUS MAJESTY QUEEN VICTORIA.

President:

Sir Charles Lemon, Bart., F.R.S., &c.

Vice-Presidents:

Right Hon. Viscount Falmouth.
J. Tremayne, Esq.
Robert Hunt, Esq., F.R.S.
C. D. Bevan, Esq.
Rev. T. Phillpotts, M.A.
C. Fox, Esq.

R. Taylor, Esq., F.G.S.
Rev. W. Rogers, M.A.
Right Hon. Earl Mount Edgcumbe.
J. J. Rogers, Esq., M.P.
S. Gurney, Esq., M.P.
T. G. Baring, Esq., M.P.

Treasurer:

Edward Brian Tweedy, Esq.

Honorary Secretaries:

Rd. Taylor, Esq., F.G.S.
Lieut. J. S. Jago, R.N.

R. C. Vigurs, Esq., M.B.
Thomas Rogers, Esq.

Secretary:

Mr. Sydney Hodges, Falmouth.

A List of the Premiums and Prizes will be found in the following pages.

LIST OF PREMIUMS AND PRIZES

FOR 1863.

PREMIUMS.

NOTICE.—The Society in all cases reserves the power of rewarding each communication in proportion to its merit, or even of withholding the Premium altogether.

Competition not confined to members, or residents in Cornwall.

1. MINE VENTILATION.—The following sums have been subscribed for promoting Improved Ventilation in Cornish Mines :—

Royal Cornwall Polytechnic Society	£50
Hon. Mrs. Agar	10
John J. Rogers, Esq., M.P.	10
United Mines Adventurers	10
T. J. A. Robartes, Esq., M.P.	5
Rev. H. Molesworth St. Aubyn	5
Augustus Smith, Esq., M.P.	5
C. F. Giesler, Esq.	5

Two premiums, one of £50 and another of £25, to be given to the first and second best of the two mines in which, under the circumstances of the case, the ventilation shall be most complete ; regard being particularly had to "close ends," and the extent to which effective ventilation is carried from the main natural draughts. The effectiveness of the ventilation, to be attested in such manner as the adjudicators of the premiums may deem satisfactory. The premiums awarded are to be paid to the adventurers of the mines for distribution.

A premium of £10 for the best model, and a premium of £5 for the best plan, for increasing the ventilation of mines.

2. DRESSING ORES.—A premium of £20, by the Editor of the *Mining Journal*, and by the Society (for such portion thereof as the judges shall consider suitable,) to the originator of improvements in the dressing of ore ; such improvements to have been in successful operation for a period of not less than six months.

3. IMPROVEMENT IN MINING.—A premium of £5, by the Editor of the *Mining Journal*, for the best Paper containing an account of any methods, or plans, practised in any other mining districts, advantageously applicable to the Cornish Mines. To be accompanied by the necessary drawings.

Note.—The introduction of improved methods of drawing the ores and rubbish from the Cornish mines appears to the committee to be worthy of attention with reference to this premium.

4. MINERAL VEINS.—A premium of £2 by the society, and £3 by Sir C. Lemon, Bart., for the most exact account for the phenomena of mineral veins in any mine or district, their dip, direction, variations in productiveness, slides, heaves, &c. The Society being especially desirous of cultivating close habits of observation in our miners, will give prizes for accurately drawn cross sections; for collections of *ore* and *country* in which the relations of one to the other are carefully marked; for drawings and descriptions of any remarkable phenomena observed in lodes, &c.

5. CONSUMPTION OF COAL, &c.—A premium of £5 5s., by John Taylor, Esq., F.R.S., for the most complete and accurate accounts of the quantity of water supplied to the boilers, the number of bushels of coals consumed, and the duty performed by an engine, for a period of not less than six months.

6. WORKING PLAN OF A MINE.—A premium of £5 5s., by the society, for the best working plan of a mine in full work (sections of the lodes not required). The plan to be corrected to some time within three months previous to its exhibition. To be drawn by the person who dialled the mine-workings.

7. A premium of £5 by the society, for the best machine or model for boring rocks, the effective working of which must be attested.

8. A premium of £5 for the best model of a small steam-engine applicable for raising water from trial shafts of not less than 30 fathoms in depth, in new mines without expensive erections.

9. The following has been forwarded by Charles Fox, Esq. "The value of copper ore in any state is soon ascertained, and unless of very low produce, can bear the expense of carriage. Tin stuff, when in considerable quantities, requires more investigation to judge of its value. In many parts of the county purchasers of it in the stone are not to be met with, whilst the expense of carriage to stamps (if the use of any be attainable) may be too heavy an item in the returning charges. This also applies to some copper halvans and skimpings. I therefore offer premiums of 3, 2, and 1 guineas for the first second, and third class models of steam stamps (to possess a stamping power equivalent to that of 3 or 4 heads) which may be removable from place to place, whether attached to wheels, or on frames to be transported on a waggon, Or for such improvements, especially in the stamping part, in steam stamps whether stationary or locomotive, as may simplify the machinery, whether of the engine or of the stamps, without impairing its efficiency. Should the judges not be able to decide that such alterations are on the whole an undoubted improvement, the premium should be considered as earned, if they recommend them as clearly deserving of trial. The crushing of some descriptions of tin stuff and of gold quartz, under rolls running round on a bed, as in powder and manganese mills, and in preparation for stamping, should not be lost sight of, the continuous motion of the rolls being a saving in the power, although the heads might need to be lifted higher to stamp it afterwards, than if working on rougher tin stuff. When stamps are not stationary, the dressing floors (to save expense) would no doubt be limited to the buddles, &c., necessary for returning the cross tin, and the remainder, if worth it, might be dressed subsequent to the removal of the stamps."

PRIZES.

MECHANICAL DEPARTMENT.

NATURAL PHILOSOPHY.—CHEMICAL ANALYSIS.
MECHANICAL AND OTHER SCIENTIFIC INVENTIONS AND IMPROVEMENTS:—
MODELS OF MACHINERY, NOT DISPLAYING INVENTION.—
NAVAL ARCHITECTURE.

Inventions and improvements must be accompanied by accurate models or drawings, and explicit descriptions. The drawings to be sufficiently large to be distinctly seen; and all descriptions or communications should be written on foolscap paper, on one side only, leaving 1½ inch margin.

The Society will place at the disposal of the judges a certain number of prizes to be awarded to apprentices and artizans, for good workmanship.

FINE ARTS.

FOR AMATEURS ONLY.

SCULPTURE AND MODELLING.—OIL PAINTING.—WATER COLOURS.—PENCIL, CRAYONS, ETC.—ENGRAVING AND ETCHING.—LITHOGRAPHY.—ARCHITECTURE.—ORIGINAL DESIGNS ADAPTED FOR MANUFACTURES IN SERPENTINE, GRANITE, PORPHYRY, ETC.

Special premiums of £1 each are offered for the following subjects:—

1. For the best filled sketch-book from Nature.
2. For the best series of six flowers from Nature, in chalk or pencil.
3. For the best series of six sketches, in water colours, of different rocks, showing their jointed structure and characteristics.
4. A premium of £2 for the best copy in oil of any genuine picture by the old masters.
5. Ditto of £1 for the best copy in water colour of ditto.
6. For Six outlines of stems and branches of British Trees, on imperial-size paper, giving carefully the forms of leaves and characteristics of stems.
7. For the best series of original sketches of our Cornish Antiquities,—Celtic, Roman, or Saxon.
8. For the best series of six outlines of the human hand or foot, life size, from the cast, or from life; indicating light and shade by the lightness or strength of the outline.
9. For the best shaded crayon drawing of one of the busts in the Polytechnic Hall, full size, or the bust of any well-known character.
10. For the best engraving on wood, or best lithograph.
11. For the best series of not less than 12 photographs. N.B.—A Silver Medal will also be awarded for the best photograph exhibited by either an amateur or professional photographer.

SCHOOL PRODUCTIONS.

PRIZES FOR SCHOOLS, OR YOUTHS UNDER 16 YEARS.

A prize of £1, for the best series of six perspective outlines, with original illustrations.

Prizes of 10s., 7s. 6d., and 5s., for the best mechanical drawings.

Prizes of 10s., 7s. 6d., and 5s., for the best series of drawings from objects or models.

Prizes of 10s., 7s. 6d., and 5s., for the best water-colour drawings, original.

Prizes of 10s., 7s. 6d., and 5s., for the best pencil or crayon drawings.

Prizes of 10s., 7s. 6d., and 5s., for the best maps.

Prizes of 10s., 7s. 6d., and 5s., for the best specimen of penmanship.

Note.—Plain writing and printing on a sheet of foolscap, will better meet the views of the committee than the more decorative styles.

Prizes of 10s., 7s. 6d., and 5s., for the best series of drawings from objects or models, by boys belonging to National and British Schools.

N.B.—The Society are compelled to limit the competitors belonging to the same school to three in each section of school productions. Such competitors to be selected by the masters of the respective schools.

NATURAL HISTORY.

ESSAYS.—LOCAL OBSERVATIONS.—COLLECTIONS OF SPECIMENS, PARTICULARLY SUCH AS ILLUSTRATE THE NATURAL HISTORY OF THE COUNTY.

Specimens must be properly arranged, and accurately named.

Prizes will be especially given for Monographs of any particular family or large genus indigenous to the county, either in Botony or Zoology, such as the *Gramineæ* or the *Hieraceæ;* the *Holothuriadæ* or the *Medusæ;* the *Palmipedæ;* the *Rodentia*, &c., &c.

A premium of £2 2s. for the best Illustrated Journal of Natural History.

A premium of £2 for the best Calendar of Nature, presenting in a tabular form the comparative view of the dryness or moisture of different years; exhibiting also the advance of the seasons by the time at which various trees, plants, &c., burst into leaf or flower, taking, of course, the same tree each year. The candidates to be under 18 years of age.

STATISTICS.

Communications in this department should relate to subjects connected with the county of Cornwall.

Lander Prizes, for Competitors under 18 Years of Age.

Charles Fox, Esq., offers to the Society, as long as he continues a member of it, the sum of £4 annually, to be distributed in the respective sums of £2, £1, 12s., and 8s., in four several prizes, for the neatest and most correct maps of some one state, province, or European colony, comprising not less than 4C0 square miles; or a portion of not less than 100 square degrees of some uncivilised region. These prizes to be called the *Lander Prizes*, in commemoration of those enterprising travellers, Richard and John Lander. The principal rivers, lakes, chains of mountains, line of sea-coast (if any), and territorial line, should be accurately delineated; and the sizes of the most important cities or towns, with their latitudes and longitudes, should be correctly marked. The maps should be accompanied by the best information (with reference to authority) respecting the great physical features of the country, such as particulars relating to the principal rivers flowing through it; the length of course; breadth at different places; tributary streams, lakes and canals; periodical rise, average fall per mile, and the rapidity of current; the progressive increase of alluvial deposit, and the obstructions which may be opposed to navigation:—the characteristics of the principal chains of mountains in such country; their general direction, height, geological and mineralogical features, more important passes, limits of perpetual snow, and the elevations at which various trees and plants will flourish on their sides; or information respecting the population of its principal towns and cities, with the statistics of their trade and manufactures, or the natural productions of the country, zoology, botany, &c.

It is not expected that each map will be accompanied with information on all the subjects specified; they are named as affording hints to guide the juvenile competitors and to prompt them to compilation and original research.

FANCY WORK.

Prizes for the best specimens of Lace-work, Berlin Wool-work, Embroidery Crochet, &c.

PLAIN WORK.

Prizes will be given for specimens of Plain Work, and special prizes of 7s. 6d., 5s., and 2s. 6d. for the best made Linen Shirt, and 5s. for the best pair of Knitted Socks, provided not less than three pairs are sent in, by children under 14.

ESSAYS, SCIENTIFIC PAPERS.

Communications of interest relating to the county, which may be forwarded to the Society, will, if approved by the committee, be printed and circulated with the Society's Annual Report.

FREE LOAN OF DRAWINGS, ETC.

A collection of Drawings and Prints, comprising studies from Raphael, and Lithographs by Harding and others, have been presented to the Society by the Misses A. M. and C. Fox, for the purpose of affording good copies to those schoolboys and others who may wish to borrow them.

Persons wishing to borrow any of the above, must be recommended by a member of the society, and may apply at the Polytechnic Hall, or by letter addressed to the Secretary.

REGULATIONS FOR COMPETITION, &c.

Competitors are divided into four classes:—

The FIRST CLASS consists of Members of the Society; also of persons who pay 3s. to be allowed to compete for prizes. First class competitors are entitled to admission on the first day of the exhibition, after 12 o'clock.

The SECOND CLASS consists of persons of the working order.

The THIRD CLASS consists of Schools for the higher branches of education.

The FOURTH CLASS consists of Schools for the children of the working orders.

The second, third, and fourth classes may compete for prizes without any subscription, but are not entitled to free admission to the exhibition.

The sealed notes should be sent to the Secretary by every competitor, each endorsed on the outside with some distinguishing motto or private mark. One should contain a full description of the articles sent, and state the class and department in which it is to compete; the other note should be marked "private," and contain the name and address of the competitor.

Articles sent for competition, and the cases in which they are contained should have the same distinguishing marks as the notes mentioned in the last paragraph.

No person shall be entitled to a prize for any article which has appeared at a previous exhibition, unless exhibiting some improvement.

In the department of the Fine Arts, competitors must distinctly state whether their productions are original or copies.

It is optional with the judges, either to award a medal, or a sum of money instead of it, according to the following scale:—

First Silver Medal	£7	0	0
Second ditto	5	0	0
First Bronze Medal	3	0	0
Second ditto	1	10	0

Medals only, not convertible into money, can be awarded to patented or registered articles.

Persons who may have medals awarded to them shall not be at liberty to exchange the same for their nominal value in money, unless they have received similar medals at any previous Exhibition of the Society.

No competitor may receive more than one medal or prize for similar subjects in the same department at the same Exhibition. (This regulation does not apply to mechanical or scientific inventions.)

No holder of a medal or prize may receive a prize of the same, or a lower value, for similar subjects in the same departments at the *next* two subsequent Exhibitions. But the judges will be empowered to give rewards in special cases to persons excluded by this rule.

The carriage of all articles sent to the Exhibition must be prepaid, unless permission to the contrary has been previously obtained from the committee.

RULES FOR MEMBERSHIP.

An annual subscription of 5s. and upwards constitutes membership.

Persons not resident in the county may become life members on payment of £5.

Each member is entitled to a non-transferable ticket, giving admission at all times to the Annual Exhibition and Lectures, for a subscription of 5s.; and a transferable ticket for every additional 5s.; and is allowed to compete for any of the prizes offered by the Society. Subscribers of one pound are entitled to two members and two transferable tickets, and the same for each additional pound subscribed.

Annual subscribers of 10s. and upwards, life members, and every family residing in one house who subscribe fifteen shillings and upwards, are entitled to the Society's Reports.

Subscribers not resident in the county, paying 5s. and upwards annually, and life members, are entitled to the same privileges as county subscribers of 10s. and upwards annually.

Subscriptions become due, in advance, at Midsummer.

PICTURES BY PROFESSIONAL ARTISTS.

The Society invites professional artists to forward their works to the Exhibition, the carriage of which the Society will pay. The Art Union of Cornwall has arranged to select their prizes from the pictures so exhibited.

N.B.—The Exhibition takes place in the Autumn of each year, and notice is given of the exact date some weeks previously.

Any other information respecting the Society may be obtained from the members of the committee; or the agents in the county, from whom the Reports of the Society may be obtained; or from the Secretary,

Mr. SYDNEY HODGES, Falmouth.

AGENTS.—Mr. Liddell, Bodmin; Mr. L. Newton, Camborne; Mr. S. Thrrn, Devonport; Mr. R. C. Richards and Mrs. Lake, Falmouth; Mrs. Carlyon, Helston; Mr. J. Bickle, Hayle; Mr. Cater, Launceston; Mr. N. Hare, jun., Liskeard; Mr. R. White, Lostwithiel; Mr. J. P. Vibert, Penzance; Mr. T. Docton, Padstow; Mr. J. N. Hearder, Plymouth; Mr. R. Blee, Redruth; Mr. R. Newton, St. Agnes; Mr. Giles, St. Austell; Mr. W. Kernick, St. Ives; Mr. G. S. Drew, St. Columb; Mr. Wilton, St. Day; Mr. J. Warren, St. Just; Mrs. Heard and Sons, Truro; Mr. Gill, Penryn; Mr. Robjohns, Tavistock; Mr. Cockrem, Torquay.

Simpkin and Marshall, Stationers' Hall Court; and J. Weale, High Holborn, London.

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