November 30, 1882.

ANNIVERSARY MEETING.

THE PRESIDENT in the Chair.

The Report of the Auditors of the Treasurer's Accounts on the part of the Council was presented, by which it appears that the total receipts during the past year, including balances of £2,259 4*s.* 7*d.* carried from the preceding year, and the sum received from the Acton Estate, amount to £40,350 12*s.* 2*d.*; and that the total expenditure in the same period, including purchase of stock, and deposits, amounts to £38,409 17*s.* 11*d.*, leaving a balance at the Bankers' of £1,929, and £11 14*s.* 3*d.* in the hands of the Treasurer.

The thanks of the Society were voted to the Treasurer and Auditors.

The Secretary read the following Lists:—

Fellows deceased since the last Anniversary.

On the Home List.

Adams, Andrew Leith, LL.D.
Alderson, Sir James, Knt., M.D.
Ansell, Charles, F.S.A.
Balfour, Francis Maitland, M.A.
Binney, Edward William, F.G.S.
Budd, George, M.D.
Burton, Decimus, F.S.A.
Darwin, Charles, M.A.
Dickie, George, M.D.
Gulliver, George, F.R.C.S.
Harrowby, The Right Hon. Dudley Ryder, Earl of.
Jevons, William Stanley, LL.D.
Llewelyn, John Dillwyn, F.L.S.
Newmarch, William.
Parish, Sir Woodbine, K.C.H.
Robinson, Rev. Thomas Romney, D.D.
Russell, John Scott.
Smith, Col. John T.
Thomson, Sir Charles Wyville, LL.D.
Thwaites, George Henry Kendrick, C.M.G.

On the Foreign List.

Decaisne, Joseph.
Liouville, Joseph.
Schwann, Theodor.
Wöhler, Friedrich.

Defaulter.

Armstrong, Henry Edward, Ph.D.

Withdrawn.

Farr, William, C.B., M.D., D.C.L.

Fellows elected since the last Anniversary.

H.R.H. The Duke of Edinburgh, K.G.

Ball, Valentine, M.A. (Dubl.).
Brady, George Stewardson, M.D., F.L.S.
Bramwell, Right Hon. George William Wilshere, Lord.
Buchanan, George, M.D., F.R.C.P.
Clarke, Charles Baron, M.A., F.L.S., F.G.S.
Darwin, Francis, M.A., M.B., F.L.S., F.Z.S., F.R.M.C.S.
Dittmar, William, F.C.S., F.R.S.E.
Fawcett, Right Hon. Henry, M.A.
Gaskell, Walter Holbrook, M.A., M.D.
Glazebrook, Richard Tetley, M.A.
Godman, Frederic Ducane, F.L.S., F.G.S., M.E.S.
Harcourt, Right Hon. Sir William George Granville Venables Vernon, Knt., M.A.
Hutchinson, Jonathan, F.R.C.S.
Liversidge, Archibald, F.G.S., F.C.S., F.L.S.
Malet, John, C., M.A.
Mundella, Right Hon. Anthony John, F.R.G.S.
Niven, William Davidson, M.A.
Palgrave, Robert Henry Inglis, F.S.S.
Weldon, Walter, F.C.S., F.R.S.E.

The President then addressed the Society as follows:—

Our anniversary is in one sense the opening of a new year, in another it is the close of an old one. With one hand we welcome the coming, with the other we bid farewell to the departing guest. In the later parts of my present address I shall have to speak, as on former occasions, of our prospects and hopes for the future. At our more festive gathering in the evening we shall recount some of the victories which have been won over difficulties in the extension of knowledge, and shall rejoice at the gathering of old comrades and friends after our usual period of dispersion. But at the moment of taking my place in the chair to which you have now for the fourth time elected me, I must confess that the sadder side of the picture is the most prominent. We seem almost for the moment to enter the Valley of the Shadow of Death, or, like Dante, to descend to the place of Departed Spirits, and to commune with them once more after they have vanished from the upper world. Each year during my own term of office the numbers lost to us have been greater than the numbers gained; but this year, although the list of deaths is long and comprises not a few distinguished Fellows, they all seem overshadowed by two prominent figures. One of these died in the fulness of years, of honours, and of world-wide reputation; the other in the strength and buoyancy of youth, a buoyancy which appears to have even contributed to his end.

Of Darwin and his works it is not for me to speak. Others, with wider knowledge, after longer intercourse, and with greater authority, have said what was possible at the moment, and the full story of

his life is now being written by faithful hands. But I consider it no common piece of fortune to have lived within easy distance of his house: to have been able by a short pilgrimage to enjoy his bright welcome, and his genial conversation, and to revive from time to time a mental picture of that my ideal of the philosophic life.

Of Balfour I knew far less, and his works are beyond my range of knowledge. But such was the fascination of his speech and his demeanour that to have seen him was to desire to know him better. To have been selected at his age as one of the Secretaries of the British Association, a post usually reserved for men of more advanced years and of longer experience, to have been appointed to a professorship founded almost on the basis of his own work, and thereby to have become the coadjutor of his own great master in the Physiological School at Cambridge, and all this without one word of cavil or of criticism, was a high testimony to his scientific eminence. But far wider afield, it will be remembered of him, not so much that he was brilliant in intellect, or keen of insight, or varied in his attainments, but that he always found himself among friends, whether in college or in the laboratory, in his own home over the northern border, or on the wild mountain side where he breathed his last.

The list of deceased Fellows comprises other eminent names, many of whom will receive mention in our obituary notices. The list, moreover, serves again to exemplify the variety of qualifications which have opened our doors to election. In Decimus Burton we find an architect of refined taste and cultivated mind; in Stanley Jevons and William Newmarch statisticians of weight, and the former already an authority on political and other philosophy; in Sir Woodbine Parish a geographer, and more than a geographer, a man who by service as well as by study in foreign lands had acquired an unusual amount of first hand and accurate information; in Scott Russell an engineer whose brilliant early strokes of work will be remembered when the difficulties which entangled his later efforts have been long forgotten; in Dr. Robinson a veteran and mentor in science, whose work and whose judgment were alike sound. Of Sir Wyville Thomson mention will be made elsewhere.

To this list of names there was well nigh added yet another, namely, my own. An accident, under circumstances which the issue of events and more mature reflection have shown that I was hardly justified in incurring, has for some time past interfered materially with my usual avocations in life, and thereby, as I fear, with my usefulness to the Society. But the ready and efficient assistance of the other officers has, I doubt not, gone far to supply the deficiency. For myself, I am consoled by the kind expression of sympathy from many, some even unknown, friends; and by the consideration, ever present to my mind, that, except through a combination of circum-

stances over which I had certainly no conscious control, the result to myself might have been far more serious.

The total number of Fellows lost to our ranks during the past year is twenty-two on the home list (one of whom has withdrawn on account of growing infirmities), and four on the foreign list; a result, on the whole, not very different from that of last year.

Of these two fell young, and by accident. Of the remainder, two died between the ages of 50 and 60, four between those of 60 and 70, six between those of 70 and 80; and the remaining five attained ages between four score and 90.

In Liouville we have again lost a veteran mathematician; in Wöhler, a chemist whose years, numbered from the beginning of the present century, reach to a period almost prehistoric in the records of his science.

I am happy to report that the sale of the Acton estate has been completed; and that of the proceeds, amounting to £32,250, £17,000 has been invested in preference or guaranteed railway stock; and the remainder will be expended in the purchase of ground rents, partly in the city of London, and partly in the western suburbs. The income from the latter source, already representing a very fair interest on the outlay, may be expected materially to increase at the expiration of the existing building leases. Some additional expense was incurred this year in painting a portion of the Society's apartments. A considerable portion still remains to be painted, either next year, or at some not very distant period.

While on the subject of property, I should mention that Her Majesty has sanctioned "the continuance of the occupation of the Royal Observatory at Kew by the Royal Society," upon certain conditions, which have been accepted. The building will be devoted, as heretofore, to the use of the Kew Committee, whose work, it must be remembered, is provided for in the main by the Gassiot Fund.

Last year the Society accepted a portrait of Sir J. D. Hooker, painted by Mr. John Collier, at the request and at the expense of a considerable number of Fellows. I trust that the Society will approve the action of myself and a few others, in this year offering for our collection a portrait, by the same artist, of Mr. Joule.

Mr. A. Le Gros has presented to the Society a bronze medallion head, executed by himself, of the late Mr. Darwin; and Mr. Budgett has again enriched our funds by a gift of £100.

The Library has received many valuable contributions both from our Fellows and from others. Among the latter I may mention the completion of "The Lepidoptera of Ceylon," from the Government of Ceylon; G. Retzius' "Gehörorgan der Wirbelthiere," from the author; a new edition of Abel's works, from the Norwegian Government; and facsimile lithographs of some of the late Professor

Clifford's mathematical fragments, and the catalogue in two handsome volumes from the Public Library of Victoria.

The printing of the general part of our library catalogue is in progress, and has reached the letter W; and although, owing to unforeseen difficulties the hope expressed last year, that it would have been now finished, has not been fulfilled, yet there seems little doubt that early next year it may be in the hands of the Fellows.

On the completion of this work the Library Committee contemplate resuming another decade, 1874–83, of the great Catalogue of Scientific papers; and the President and Council trust that the success which has attended the publication of the eight volumes already in existence will justify the Treasury in undertaking the printing of the second supplement when the MS. has been prepared.

In the staff of the Society I have happily no change to report. Of the existing members my own feelings would impel me to say much more; but, while they would probably wish me to be silent, I trust they will pardon me in this one remark: that while recent changes make me less apprehensive of any future alterations, they at the same time make me hope that any alteration may be long postponed.

Although the number of papers presented to the Society during the past year, apart from their contents, does not convey any very important information, yet in continuation of past practice I may perhaps carry on the ten years' table. It is as follows, showing a slight diminution in the past year:—

1873	.. ..	92 papers received.
1874	.. ..	98 ,, ,,
1875	.. ..	88 ,, ,,
1876	.. ..	113 ,, ,,
1877	.. ..	97 ,, ,,
1878	.. ..	110 ,, ,,
1879	.. ..	118 ,, ,,
1880	.. ..	123 ,, ,,
1881	.. ..	127 ,, ,,
1882	.. ..	109 ,, ,,

Among the papers of this year, I may notice the elaborate research by Dr. Debus on "The Chemical Theory of Gunpowder," forming the Bakerian lecture; the careful and long-continued investigations by Professors Liveing and Dewar on the spectra of water, and of carbon, and of mixed vapours.

Nor must I omit mention of Dr. C. W. Siemens' bold and original theory of the conservation of solar energy, which has already given rise to so much discussion. It will be sufficient for me here to say that upon the questions therein raised the last word has been by no means said; and that, whether the theory be ultimately established, or

whether, like a phœnix, it shall hereafter give rise to some other outcome from its own ashes, it will ever be remembered as having set many active minds at work, and will always have a place in the history of Solar Physics.

In Mathematics, definite integrals, and elliptic and the higher transcendents continue to occupy much attention, and in particular our "Transactions" contain an excellent contribution to the theta-functions of two variables, by Mr. Forsyth, of Liverpool. To the theory of invariants, Professor Malet, of Cork, has given a happy extension in the direction of linear differential equations; but it is unnecessary to speak in detail of papers which either already are, or will shortly be, in the hands of the Fellows. I will only add that the "Philosophical Transactions" for 1882 will probably exceed in bulk, and not yield in interest to, those of any former year.

Looking outside the circle of our own publications, there has been one step gained during the past year, which, although in some sense a matter of detail, is really of great importance and interest. I allude to the paper by Lindemann, "Ueber die Zahl π" ("Mathematische Annalen," Band xx, p. 213). It had long since been shown that both the numbers π and π^2 are irrational; but hitherto no proof existed of the impossibility of effecting the quadrature of the circle by means of the straight line and circle, and ruler and compasses. Regarded from an algebraical point of view, every such construction must depend upon the solution of a quadratic equation, or rather of a series of quadratics whereof the first has for its coefficients rational numbers, and the succeeding members of the series only such irrational numbers as occur in the solution of their predecessors. This being so, the final equation can always be transformed, by transposition of terms and squaring, into an equation of an even degree with rational coefficients. And, consequently, if it can be proved that π cannot be a root of any algebraic equation whatever with rational coefficients, the impossibility of the quadrature of the circle will be thereby also proved. Starting from Hermite's researches ("Comptes Rendus," 1873), in which he established the transcendental nature of the number e, Lindemann has supplied the proof required with reference to the number π. It must be admitted that the proof is neither very simple nor very easy to follow; and it remains only to be hoped that it may some day assume such a form as may influence the minds which still exercise themselves upon the hopeless problem of squaring the circle.

A most important change in the relations between the Society and the Government in respect of State aid to science has been made this year. It will be in the recollection of the Fellows that an experiment was made for a period of five years, during which the sum of £4,000 was annually voted to the Science and Art Department, to be distributed at the recommendation of the Government Fund Committee of

the Royal Society. That experimental period terminated, as then mentioned in my address, last year. The grant to the Science and Art Department has been discontinued, and in place of it an addition of £3,000 per annum has been made to the Government grant, making £4,000 in all. In concluding this arrangement the following stipulations were agreed to. The increased grant is to be administered by a Committee identical with the late Government Fund Committee; a portion may be devoted to personal grants, subject, however, to special recommendations to the Treasury; and, lastly, unexpended balances may be carried forward from year to year, as has hitherto been the case with the old Government grant only. To the stipulation that the increased fund should be administered by the more extended committee the Society felt that no reasonable objection could be offered, because upon it the President and Council are represented in full, and the *ex officio* members are in the majority of cases Fellows of the Society. The object of the second stipulation was, so far as the Society is concerned, to secure at the outset for the personal grants the consent and support of the Treasury, and thereby to preclude the chance of objection being subsequently taken to any of our proposals under this head. The President and Council, however, recognising the importance of great caution in respect of personal grants, have of their own motion appointed a special sub-committee (in addition to the three previously existing), to which all personal applications recommended by any of the other sub-committees are specially referred, and without whose recommendation none can come before the General Committee. To the third mentioned point, viz., the power of retaining unexpended balances, the President and Council attach great value, because that power may enable the Committee to devote more of its funds than heretofore to some of the larger undertakings in scientific enquiry, leaving more of the smaller grants to the special funds already in existence in the hands of the Royal and other societies. The meetings of this Committee will probably take place twice a year, in May and November. In the present year it will not be possible to hold the second meeting before December, but there will be advantages in holding it hereafter in November, as the entire annual grants will then be made by the same Committee, and under the sanction of the same President and Council. In concluding these few remarks on the new arrangements, I cannot refrain from expressing my sense of the obligation under which the Society and Science at large are laid by the sympathetic and intelligent attention bestowed upon the subject by the then Financial Secretary of the Treasury, the late Lord Frederick Cavendish.

Among other subjects referred to the Royal Society by Public Departments, I may mention a request from the Board of Trade for advice upon the question of improving the existing means at the

Standard Office for the purpose of comparisons. At the request of the President and Council, Sir George Airy, Colonel A. Ross Clarke, and Professor Stokes acted as a Committee, and drew up a very careful report, the value of which was fully recognised by the Board of Trade. The report suggested certain improvements in the present arrangements; but, having reference to the duties of the Standard Office as defined by Act of Parliament, it was not considered necessary to insist upon extreme scientific accuracy, such, *e.g.*, as that attained by Colonel Clarke himself in his "Comparison of Standards" made at the Ordnance Survey Office at Southampton in 1866.

The arrangements for the observation of the Transit of Venus have been steadily progressing. The parties have now all started for their stations, after their period of training under the superintendence of Mr. Stone at Oxford. An adequate supply of instruments has been secured at moderate cost, and all the accessory parts have been procured and applied by the indefatigable care and forethought of our directing Astronomer.

The English Expeditions for the observation of the approaching Transit of Venus are organized as follows:—

ACCELERATED INGRESS.

Madagascar Observers.—Rev. S. J. Perry.
Rev. W. Sidgreaves.
Mr. Carlisle.

Cape Observatory Observers.—Mr. Gill and Staff.

Aberdeen Road Observers.—Mr. Finlay, First Assistant of the Cape Observatory.
Mr. Pett, Third Assistant of the Cape Observatory.

Montagu Road Observers.—Mr. A. Marth.
Mr. C. M. Stevens.

RETARDED INGRESS.

Bermuda Observers.—Mr. J. Plummer.
Lieut. Neate, R.N.
Capt. Washington, R.E.

Jamaica Observers.—Dr. Copeland.
Capt. Mackinlay, R.A.
Mr. Maxwell Hall.

Barbadoes Observers.—Mr. C. G. Talmage.
Lieut. Thomson, R.A.

Besides the observers at these stations, the Canadian Government has arranged to place three 6-inch and some smaller telescopes in the field. Lieut. Gordon of Toronto was sent by the Canadian Govern-

ment to England to make himself master of the proposed arrangements, and to secure the necessary instrumental equipment.

ACCELERATED EGRESS.

The stations for Retarded Ingress are also available for Accelerated Egress.

RETARDED EGRESS.

Brisbane Observers.—Captain W. G. Morris, R.E.
Lieut. H. Darwin, R.E.
Mr. Peek.

New Zealand Observers.—Lieut.-Col. Tupman, R.M.A.
Lieut. Coke, R.N.

Besides these observers sent specially from England, the Observatories at Melbourne and Sydney are most favourably situated for observing the Egress. The Directors of these Observatories, Mr. Ellery and Mr. Russell, have promised their co-operation, and their Governments have placed funds at their disposal to cover any necessary expenses.

Unless unfavourable weather should prevent the transit being seen at some of the stations, we may expect some nine or ten pairs of corresponding observations, both at Ingress and Egress, from the British expeditions alone. These observations are certain to be largely supplemented by those made by the observers of other nations; and it is hoped, from the close agreement between the instructions issued to the different observers, that the whole may ultimately be available for combination in one general discussion.

The American astronomers, encouraged by the partial success which attended the plan they adopted in 1874, are relying chiefly upon the photographic method; they have sent expeditions to South America and the Cape of Good Hope.

Austria does not take any active part in observing the Transit.

France sends out eight well equipped expeditions, full particulars of which have been published in the "Comptes Rendus" for October 2.

From Holland no special expedition will be sent out, but Lieutenant Heyming, of the Dutch Navy, will observe the transit in the West Indies, probably at Curaçoa.

Italy will confine its operations to observatories in that country.

Russia, also, has decided to send out no expeditions of its own, but it has aided the efforts of other countries by lending a 6·5-inch reflector to the Danish Government, and has placed two excellent 4·3-inch heliometers in the hands of the French astronomers, MM. Tisserand and Perrotin. The considerations which led the Russian Government to this conclusion have been explained in the following paragraphs of a letter from Mr. Struve to myself:—

"Experience since 1874 has sufficiently proved that there is no prospect whatever, even with combined international efforts, of

obtaining by the present transit a geometrical determination of the parallax of the sun, which would not soon be surpassed in accuracy by other recent methods (for example, that suggested by Mr. Gill), methods which are capable of being repeatedly employed, and that without any costly expeditions.

"Further, although it must be admitted that so rare an opportunity of studying the atmosphere of the planet ought not to be neglected, yet it seems certain that many and excellent data will be obtained through the agency of the United States, as well as by other countries having well provided observatories in the southern hemisphere, as well as by other seafaring nations." Under these circumstances Russia has not considered it incumbent on itself to organise any observing parties.

Spain has sent two parties of naval officers, well equipped with 6-inch equatoreals and other instruments, to the Havana and Porto Rico.

Last year I expressed a hope that the difference of longitude between Singapore and Port Darwin in Australia would be determined by Commander Green of the United States' Navy in concert with Mr. Todd. This operation, however, in consequence of some incorrect information furnished to Commander Green as to the intentions of our home authorities in the matter, was not carried out. After various proposals, extending over a period of not less than two years, I am happy to say that it now appears likely that the work will be performed. Through the liberality of the Secretary of State for War an extension of leave has been granted to Lieutenant Darwin, who accompanies Captain Morris to Brisbane to observe the transit of Venus, enabling him to undertake the work. He has received instructions to arrange with Mr. Todd all details of the operation. The publication of the results obtained by Oudemans and Pogson for the difference of longitude between Madras and Singapore has now left only one link wanting, namely, that between Batavia and Port Darwin, to connect Australian with English longitudes. Lieutenant Darwin is eminently qualified for the work; and it seems a happy coincidence that it should fall to his lot to connect astronomically the distant port named after his father with the furthest ascertained point in that direction. I should not omit to add that Mr. Todd has placed all the telegraphic appliances under his command at the disposal of this service, and it is to be hoped that the determination will prove as useful to the Australian colonies as it will be valuable for the purposes of the transit. The best thanks of the Committee have already been given, but I am glad here publicly to recognise the valuable assistance rendered to the Committee in these long negotiations by the Great Eastern Telegraph Company.

In the course of last year the Treasury made known to the Society that in consequence of Sir Wyville Thomson's ill health, their Lordships proposed that his chief assistant, Mr. Murray, should undertake the general editorship of the Reports of the "Challenger" Expedition; so that Sir Wyville might devote himself more exclusively to the personal narrative. At the request of their Lordships a small Committee, with whom Mr. Murray might consult from time to time, was appointed, consisting of the President and Officers, Sir Joseph Hooker and Professor Huxley; but before the Committee could meet the lamentable death of Sir Wyville Thomson occurred. They met, however, shortly afterwards, and having added Professor Moseley to their number, they received from Mr. Murray, who attended, a detailed statement of the existing condition of the whole arrangements connected with the Report. From this statement it appeared that, in addition to the original estimate of £20,000 given by Sir Wyville Thomson, the work actually in progress and entrusted to the several authors required a further sum of about £20,000, and that if the series should be completed, by describing on the same scale groups as yet unallotted, an additional expense of about £6,000 would be entailed. In forwarding this statement to the Treasury, the Committee stated that, in their opinion, Mr. Murray's estimates were drawn up with great care and judgment, and that in view of the remaining Reports being carried out on the same scale as those already published, they were reasonable and sound. As to the cause of the great discrepancy the Committee felt themselves unable to offer any explanation; the conduct of the whole business having been left in Sir Wyville's hands, without reference to the Society. They further were of opinion that Mr. Murray might safely be entrusted, under the control and supervision of the Committee, with the entire future management of the undertaking.

After some further correspondence it was suggested that Mr. Murray should furnish the Committee with a statement of the existing condition of the Reports and their management, which should form a starting point for the responsibility of the Committee; and that he should keep the Committee well informed from time to time of the progress of the undertaking. These suggestions were cordially accepted by their Lordships, and with the general statement which Mr. Murray submitted in October, the special duties and responsibilities of the Committee have begun.

Since last year, three more volumes of the Report have been published, making six in all. The new volumes form volumes iv and v of the Zoology, and volume ii of the Narrative. The latter volume comprises the magnetic results, the meteorological observations, the report on the pressure errors of the thermometers, and the petrology of St. Paul's rocks. Vol. i of this section, containing the narrative

proper, is partly in type; and will, it is hoped, be issued during the summer of 1883. Other volumes also will appear from time to time.

In connexion with this subject, I may mention that the collection of specimens from the "Challenger" Expedition are being received at the British Museum, as the particular portions are released by the progress of the publication of the Report. Those derived from the "Alert" Expedition to the South Pacific Ocean, have been deposited in the Museum by the Admiralty, and are now being arranged and described. Dr. Günther hopes to be able to produce a printed descriptive catalogue of the collection before the expiration of the present year. And I desire here to acknowledge the service rendered to science by the Admiralty in commissioning Dr. Coppinger to accompany that expedition for scientific purposes.

I am indebted to Mr. Murray for the following interesting account of a cruise made last summer to complete some part of the "Challenger" work.

H.M.S. "Triton" was engaged, from the 4th of August to the 4th of September, in a re-examination of the physical and biological conditions of the Faroe Channel.

The chief objects of the cruise were to ascertain by actual soundings, the character of a ridge running from the north of Scotland to the Faroe fishing banks, and separating, at depths exceeding 300 fathoms, the cold Arctic water with a temperature about 32° from the so-called Gulf Stream water on the Atlantic side with a temperature of 47° F. This ridge was traced in considerable detail by means of cross soundings directly across the channel, and the top was found to be on an average about 260 fathoms beneath the surface. In the northern half of the ridge, however, a small saddle-back was found with a depth of a little over 300 fathoms, through which some of the Arctic water seemed to flow and to spread itself over the bottom on the Atlantic side of the ridge. The top of the ridge is entirely composed of gravel and stones, but mud and clay are found on either side at depths exceeding 300 fathoms. Many of the stones are rounded, and some of them have distinct glacial markings. They are fragments of sandstone, diorite, mica-schist, gneiss, amphibolite, chloritic rock, micaceous sandstone, limestone, and other minerals. The ocean currents here appear to be strong enough, at a depth of between 250 and 300 fathoms, to prevent any fine deposit, such as mud or clay, being formed on the top of the ridge. All the indications obtained of the nature of this ridge, seem to imply that it may be a huge (terminal ?) moraine.

It is worthy of notice that the "Wyville Thomson Ridge" is only a little to the east of the position marked out by Croll from the observations of Geikie, Peach, and others, as the probable limit of the perpen-

dicular ice cliff formed in North Western Europe during the period of maximum glaciation.

The dredging captures show the same marked difference as had previously been pointed out in the fauna of the two areas; those in the cold area being of a distinctly Arctic character, and those in the warm area resembling the universally distributed deep-sea fauna of the great oceans. A fair proportion of new species were also found.

The last trip of the "Triton" took place from Oban, on the 11th September, to the deep water in the Atlantic westward of Ireland. The object of this trip was to get *directly* a determination of the pressure unit of the gauges employed in testing the "Challenger" thermometers. The original determinations were made *indirectly* by the help of Amagat's results as to compression of air. The observations taken are not yet reduced, but several successful trials were made at depths of 500, 800, and 1,400 fathoms.

The subject of the Circumpolar Observations mentioned in my address of last year, was since that time brought more formally before our Government by that of Russia. At the request of the Treasury, the President and Council, after consultation with the Meteorological Office, advised as follows:—

"The object of the undertaking is to throw light on the influence of the great inaccessible region surrounding the pole on the meteorology and magnetism of the earth. With this view it is proposed to take simultaneous observations at a chain of circumpolar stations for a full year at least.

"A chain of not less than eight stations will be occupied independently of any co-operation by this country. This chain, however, leaves a gap of 90° in longitude in the northern part of America, the centre of which would be advantageously occupied by a station in the Dominion of Canada. The value of the results will be greatly enhanced by the addition of this link to the chain. Independently of this, such a station would be of great value as being of a continental character, in contrast with the other stations, which are in close proximity to the coast. By choosing for the station one of the forts of the Hudson's Bay Company, no great outlay need be involved in its occupation."

The point first proposed was Fort Good Hope, near the mouth of the Mackenzie River; but it was found too late to erect the necessary huts and to transport the party and its provisions there during the present season. Fort Simpson, on the same river, was next suggested. Guided by considerations of facilities of access and sustentation, the Committee came to the conclusion that either Fort Rae or Fort Providence, on Great Slave Lake, is to be preferred to Fort Simpson, with which the former forts nearly agree in latitude; and accordingly the President and Council recommended one of these.

"In framing an estimate, it was thought well to assume that the expedition might last a year and eight months, so as to allow a sufficient margin for travelling to and from the station, and for possible detention in waiting for the Hudson's Bay Company's brigade. It is calculated that the cost might be safely estimated at £3,000, which would include salaries of one officer and three men; journey of the party from England and back, including reasonable baggage; rations, allowances, and all other expenses."

To this communication the following reply was received:—

"My Lords have to thank you, and the Committee whom the Council appointed to advise them in the matter, for the valuable information contained in Dr. Michael Foster's letter of the 16th ultimo. Acting upon that information and upon the advice of the Royal Society, Her Majesty's Government have decided that this is an object on which public money may properly be employed, and they are prepared to ask Parliament to provide a total sum not exceeding £2,500 for the purpose. My Lords understand that there is good reason to hope that the balance required to make up the total estimated cost of £3,000 will be forthcoming from other sources.

"I am to ask whether the Royal Society would be so good as to take charge of the Expedition under similar conditions to those under which the Transit of Venus Expedition is being conducted; accounts of the expenditure chargeable to the Parliamentary grant being rendered to this Department. The choice of stations, the appointment of observers, and the methods of procedure would be left entirely to the Society, subject to the condition that the total amount chargeable on public funds does not exceed £2,500. My Lords understand that it is expected that not more than £1,500 of this amount would come in course of payment during the present year, and they will present estimates to Parliament for £1,500 and £1,000 at the proper times."

The Canadian Government has since promised a contribution of 4,000 dollars towards the expenses of the expedition.

A committee, consisting of the President, Dr. Rae, Sir George Richards, Mr. R. H. Scott, and Professor Stokes, was accordingly appointed to superintend the expedition, which, comprising Captain H. P. Dawson, R.A., in command, Sergeants J. English and F. Cookesley as observers, and W. Wedenby, as artificer, left England on May 11, for Quebec, was heard of at Fort Carlton on 27th June, and was about to proceed the next day for Green Lake, on the way to Portage La Loche. It was still not quite certain whether it might not be necessary to push on to Fort Simpson, on account of insufficient accommodation, as well as lack of time and materials for building at Fort Rae.

Two parts of "Mittheilungen der Internationalen Polar Commis-

sion" have been published, containing full particulars and instructions relating to the whole circumpolar scheme.

The geological, mineralogical, and botanical collections, formerly in the Museum in Bloomsbury, have been properly arranged in the new building in Cromwell Road, and are on exhibition in their respective galleries. A commencement has been made in the transfer of the zoological collections. The osteological specimens, hitherto packed out of sight in an obscure vault in the basement of the old Museum, have been safely removed to the new building, and are now exhibited in a large and well lighted gallery. The collection of shells, which occupied the floor space of the long eastern gallery in Bloomsbury, is now suitably exhibited at South Kensington. Some of the corals have been removed, in order to clear the way for the removal of other specimens; and many of the stuffed quadrupeds and mammalian skins which had been stowed away in the old Museum basement are now in the new repository.

The removal of the general collection of mammalia, of the birds, of the entomological specimens, and those of British zoology, will not be undertaken until after the coming winter. The fittings for the galleries prepared for them are not fully completed. The detached building designed for the specimens preserved in spirit cannot be made ready for their reception before the opening of next spring. It is, however, expected that the whole of the zoological collections will have been transferred to the new Museum by the end of June, 1883.

The subject of Technical Education has continued to be prominently under the notice of the country during the past year. The appointment of a Royal Commission on Technical Instruction, to which I have previously referred, has done much towards awakening the interest of manufacturers, and exciting curiosity in regard to the efforts that are being made abroad to improve the education of artizans. The Commissioners issued in March last their first Report, which dealt exclusively with primary education and apprenticeship schools. The Commissioners expressed an opinion adverse to the establishment of apprenticeship schools in this country; and in this view they are supported by nearly all our large manufacturers, and by the action of the City and Guilds of London Institute for the Advancement of Technical Education. At the request of the Executive Committee, I myself gave evidence before the Commission, explaining generally the objects of the City Guilds and Institute, and describing the progress already made towards their attainment. As a member of the Executive Committee of this Institute, I have watched its progress with interest, and have observed with satisfaction that its scheme of Technical Instruction is being gradually matured. The general Examinations in Tech-

nology undertaken by this Institute, were held in May last at 147 centres in 37 subjects. Of the 1,972 candidates who presented themselves for examination, 235 passed in Honours, and 987 in the Ordinary Grade. In 1881, 895 candidates passed, showing an increase of 307. The Examinations were held this year for the first time under the revised Regulations, which appear to have worked very satisfactorily. Two points deserve notice with respect to these Examinations. In the first place, the Institute experiences very great difficulty in obtaining properly qualified teachers. The applicants are either practical men working in the factory, or at their trade with no scientific knowledge whatever, or men possessing a very elementary science knowledge, and little or no practical acquaintance with the details of the industry, the technology of which they profess to understand. In order to indicate the kind of qualifications required in an ordinary technical teacher, the Institute has inserted in its programme a paragraph to the effect that persons who are engaged in teaching science under the Science and Art Department, and who at the same time have acquired a practical knowledge of their subject in the factory or workshop, may be registered as teachers of the Institute. The second point calling for consideration is the fact referred to in the Report of the Directors,—that of the 1,222 candidates who, this year, passed the examinations, most of whom are workmen or foremen in various branches of industry, not more than 450 are qualified to receive the full Technological Certificate, by having previously passed the examinations of the Science and Art Department in certain science subjects. This fact clearly indicates that widely beneficial as has been the action of this Department of State, there is still a large field for its influence among the population who are engaged in manufacturing processes, and desire to receive Technical Instruction.

One of the most satisfactory results of the Examinations of the City and Guilds of London Institute is the impulse they have given to the establishment, in different parts of the country, of properly equipped technical schools. At Manchester, Preston, Dewsbury, Hawick, Sheffield, Leicester, and other places, efforts have been made during this year towards organising schools for the technical instruction of artizans and others in the application of science and art to specific industries. At Nottingham, a grant of £500 has been made by the Institute, to be followed by an annual contribution for a limited period of £300, towards the establishment of technical classes in connection with the University College; and at Manchester a subscription of £200 a year has been promised to assist the funds now being raised for the conversion of the Mechanics' Institution into a Technical School. The attention of the Council has been greatly occupied of late with the arrangements for the opening of the Finsbury College. Classes in Electrical Engineering and in Technical

Chemistry, have been carried on for nearly three years in temporary rooms belonging to the Cowper Street Schools. The attendance at these classes has been eminently satisfactory, much more so than could have been anticipated. During the past session 960 class tickets were sold at fees varying from 5*s.* to 12*s.* The staff of the College has recently been doubled by the appointment of a Professor of Mechanical Engineering, and a Head Master to the new Department of Applied Art, the establishment of which, as I stated last year, was then under the consideration of the Committee. In January next, it is anticipated that the new building in Tabernacle Row, which is already nearly completed, will be opened for the reception of students. The programme of instruction, prepared by the Director and the Professors of the College, has been for some time under the consideration of the Committee, and it is hoped that in the instruction given in this College will be found the realization of a very important part of the Institute's Scheme of Technical Education.

Grants to the Technical Science Classes at University College and King's College, London, to the Horological Institute, to the School of Art Wood Carving, and other institutions, have been continued during the past year.

The Technical Art School in Kennington Park Road, established and maintained by the Institute, has been satisfactorily attended; and a proposition is to be brought before the Committee for supplementing the teaching of this school by technical science classes, with the view of establishing in the south of London a Technical College for Artizans, similar to the one about to be opened in Finsbury.

The building of the Central Institution or Technical High School in Exhibition Road, the foundation stone of which was laid by H.R.H. the Prince of Wales, President of the Institute, in July, 1882, is rapidly advancing and promises to be completed within a year. It is not expected, however, that this school will be ready for the reception of the students before the commencement of the session 1884–5. Meanwhile, the Council and Committee are fully occupied with the development of other parts of their scheme.

In forwarding the Report of the Meteorological Council to the Treasury in December last, the President and Council took occasion to remind their Lordships that the arrangement for the organisation of the Meteorological Office generally, in May, 1877, would terminate with the then financial year. The Treasury, in reply, asked the advice of the Royal Society. After consultation with the Meteorological Council on various points connected with the subject, the President and Council reported fully to the Treasury, and concluded with the following general recommendation: "The President and Council beg leave to express a hope that the constitution of the Meteorological Council may remain unchanged, and that the same gentlemen who have

hitherto performed its duties and administered its funds with such intelligence and judgment may be disposed to continue their labours." To this recommendation the Treasury cordially assented; deciding at the same time that no period should be fixed to the Meteorological Council for their tenure of office, but that it might be terminated by either party at any time on twelve months' notice.

The Meteorological Office has completed during the past year a series of charts of sea surface temperature, for the three great oceans of the globe, and for the representative months of February, May, August and November. The work, which is now in the course of publication, will consist of twelve large charts, for the Indian, Atlantic, and Pacific Oceans respectively; and of four on a reduced scale, showing, for the four months, the isothermal lines of sea surface temperature over the entire globe. In the preparation of these charts, all the observations existing in the Log Books of the Meteorological Office, and in the Remark Books of the ships of Her Majesty's Navy, have been employed, as well as the information which has been already rendered accessible in scientific memoirs, and in the narratives of the great scientific voyages. The isotherms agree substantially with those which have been already given for the months of February and August, in the wind and current charts published by the Hydrographic Department of the Admiralty; but as the present series is founded on a much larger number of observations than have ever before been available for a similar purpose, it may fairly be regarded as a valuable contribution to a not unimportant part of terrestrial physics. Between the limits of 50° north and 50° south latitude, the mean annual surface temperature, so far as it can be deduced from the data now available, appears to be 74°·9 F. for the Indian, 69°·5 F. for the Atlantic, and 68°·6 F. for the Pacific Ocean. The North Atlantic is 4°·6 F. warmer than the South Atlantic Ocean; the corresponding difference in the case of the Pacific Ocean is only 1°·8 F.

Among other contributions to Ocean Meteorology, which the past year has produced, I may mention (1) the Physical Charts of the Atlantic Ocean, published by the Deutsche Seewarte, at Hamburg; (2) the second volume of the narrative of the voyage of H.M.S. "Challenger," containing the magnetical and meteorological observations; and (3) a report by Captain Toynbee, F.R.A.S., on the Gales of the Ocean District adjacent to the Cape of Good Hope, which completes the discussion by the Meteorological Council of the meteorology of that tempestuous part of the sea.

The meteorology of our own country has been actively studied during the year. The Scottish Meteorological Society have given in their Journal a series of monthly pressure charts for the British Isles, together with a revised edition of the temperature charts

already published by them in 1871. The charts now embody the results of observations extending over a period of twenty-four years; the revised edition, as well as the original publication, are due to the indefatigable activity of Mr. Alexander Buchan, F.R.S.E., the Secretary of the Scottish Meteorological Society. An atlas of convenient size, intended for the use of observers in the United Kingdom, and conveying similar information derived from data partly different, and quite independently discussed, has been already prepared by the Meteorological Office, and will immediately appear.

It is a fact now universally recognised that the greater part of the changes of weather which are experienced in the British Isles are occasioned by travelling areas of excessive or defective atmospheric pressure, which arrive at our shores from the Atlantic Ocean. The importance of a systematic study of the weather of the North Atlantic being thus indicated, the Meteorological Council have resolved to undertake the preparation of synoptic weather charts for the thirteen months beginning 1st August, 1882, and ending 31st August, 1883, and have issued a special appeal to the British shipping interest for active co-operation during that period. It is satisfactory to know that this appeal has not been fruitless, and that there is every prospect that the number of observations available for the discussion will exceed 200 per day.

This is, perhaps, the proper place to make mention of some results having an important bearing on meteorology, obtained by Professor Tyndall in the course of a larger research on the action of radiant heat on gases.

By methods which he has applied to gases and vapours generally, Tyndall has established anew the action of aqueous vapour upon radiant heat, and the sensibly perfect diathermancy of dry atmospheric air. The phenomena of solar and terrestrial radiation are profoundly modified by the presence of aqueous vapour in the earth's atmosphere, the temperature of our planet being thereby rendered very different from what it would otherwise be.

The celebrated experiments of Patrick Wilson, wherein were observed a rapidity of radiation and a refrigeration of the earth's surface previously unknown, are explained by the fact that when they were made the amount of aqueous vapour in the air was infinitesimal, the unhindered outflow of heat towards space being correspondingly great. The sagacious observation of Six and Wells, that the difference between the surface temperature and that of the air a few feet above the surface, on equally serene nights, is greatest in cold weather, is explained by the fact that, when the temperature is low, the agent which arrests the surface radiation is diminished in quantity. Wells, moreover, found that the heaviest dews were deposited on nights when the difference between air temperature and

surface temperature was small; while the greatest difference between the two temperatures was observed on nights when the deposition of dew was scanty. The explanation offered by Tyndall is this:—copious dew indicates abundant vapour; and abundant vapour, by arresting the terrestrial rays, prevents the refrigeration observed in drier air. Strachey's able discussion of observations made at Madras, point distinctly to the action of aqueous vapour on the radiation both of the sun and of the earth; while the experiments of Leslie, Hennessey, Hill, and other distinguished men, which were long considered enigmatical, are readily explained by a reference to the varying quantities of vapour with which the atmosphere is charged, on days of equal optical transparency. The interesting observations of Desains and Branley, made simultaneously on the Rigi and at Lucerne, are well worthy of mention here. The difference of level between the two stations is 4,756 feet, and within this stratum 17·1 per cent. of the solar heat was proved to be absorbed. This absorption being due to aqueous vapour, is tantamount to the transmission of the sun's rays through a layer of water of a definite thickness. A sifting of the rays would be the consequence, and on *à priori* grounds we should infer that the percentage transmission through water at Lucerne must be greater than on the summit of the Rigi. This was the exact result established experimentally by Desains and Branley. Mr. H. Wild, Director of the Central Physical Observatory, St. Petersburg, basing his statement on experiments made by himself according to Tyndall's method, has expressed the opinion "that meteorologists may, without hesitation, accept this new fact in their endeavours to explain phenomena which hitherto have remained more or less enigmatical." The correctness of this statement is illustrated by the foregoing examples, to which, if necessary, many more might be added.

At the recommendation of the Committee on Solar Physics of the Science and Art Department, a grant of £350 was made from the Society's Donation Fund to Captain Abney and Mr. Lockyer in aid of their proposed observations of the total eclipse of the sun at Thebes in May last. Unfortunately the state of Captain Abney's health precluded his taking part in the expedition; but Dr. Schuster generously undertook the conduct of his observations, and, notwithstanding the short time remaining for preparation, he carried them out in the most satisfactory manner.

Three photographs of the corona itself were obtained during the eclipse. They show that the corona had the characteristic features observed during the time of the maxima of sun-spots. The long streamers in the plane of the ecliptic seen during sun-spot minima were absent, and the corona showed much disturbance. A bright comet appeared in all the photographs at a distance slightly less than a solar diameter.

A complete photograph of the spectrum of the prominences and the corona was for the first time obtained. The prominences give a spectrum in which the lines of calcium bear a conspicuous part by their intensity. The ultra-violet hydrogen lines, photographed in star spectra by Dr. Huggins, were seen, as well as a number of unknown lines.

The corona gives a very complicated spectrum. Close to the limb of the sun the spectrum was so nearly continuous and so strong as to hide any lines which might have been present. Further away the continuous spectrum fades off, the region of the solar group G appears occupied by an absorption band, and a large number of coronal lines hitherto unobserved appear in the ultra-violet.

In addition to these photographs one was obtained in a camera, in front of whose lens a prism was placed without a collimator. This photograph allows us to study the spectra of different prominences. As the picture was produced on one of Captain Abney's infra-red plates, all the tints of the prominences ranging from the ultra-red to the ultra-violet made their impressions, and some interesting differences in the spectra of different prominences can be noticed.

But, beside taking part in this expedition, Mr. Lockyer has continued with unwearied perseverance his observations on the spectra of solar prominences and spots, and has recently combined with these the results obtained by him during the late eclipse. During this eclipse he made naked eye observations, which he considers to be of a crucial character between the two rival hypotheses regarding the nature of the sun's atmosphere. The results of this investigation have in his opinion considerably strengthened the views which he first put forward in 1873 on the constitution of the solar atmosphere. A statement of these views will be found in a paper by him recently read before the Society.

In the present state of the questions there raised, it must I think be admitted that, after giving all due weight to the facts and reasonings adduced by Mr. Lockyer, additional and varied observations are greatly to be desired; and that no opportunity reasonably available, for adding to our knowledge of the subject, should be neglected. And, therefore, without committing myself or the Society to the support of any particular proposal or expedition, I think that it may be fairly claimed as a *primâ facie* duty on the part of the present generation to obtain as many faithful records of the various phenomena occurring during solar eclipses as possible.

From a discussion of the meridian observations of Mars made during the favourable opposition of 1877, at Washington, Leiden, Melbourne, Sydney, and the Cape, Professor Eastman has deduced the value 8″·953 for the solar parallax—a value which, though considerably larger than any of those found by other methods, agrees closely with

that obtained by Mr. Downing, in 1879, from the meridian observations of Mars at Leiden and Melbourne, as well as with the values found from similar observations in 1862. In this investigation, Professor Eastman rejects the observations at Cambridge, United States, as they were made in a slightly different manner, and gives (in combination with Melbourne) a very large value for the solar parallax, viz., 9″·138.

The detailed account of the British Observations of the Transit of Venus, 1874, was published at the beginning of the year, and the observations of the transit made at colonial observatories have been recently printed in the Memoirs of the Royal Astronomical Society.

The Transit of Mercury last November was well observed in Australia and other places, and the results are of special interest in connexion with the coming Transit of Venus. The discordances in the times of internal contact recorded by different observers seem to show that such observations are subject to much uncertainty.

An important memoir on astronomical refraction has been lately published by M. Radau, who, after a discussion and comparison of previous theories, gives formulæ and tables for refraction, in which allowance may be made for difference in the rate of decrease of temperature with the height above the earth's surface at different seasons of the year. M. Radau also discusses the case in which the surfaces of equal temperature in the atmosphere are inclined to the earth's surface.

A new map of the solar spectrum, containing a much larger number of lines than are shown in Ångström's classical normal spectrum, has been published by Professor Vogel in the publications of the new Astrophysical Observatory at Potsdam. In this work Professor Vogel has bestowed great care on estimates of the breadth and intensity of each line. In the same volumes are given the results of Professor Spörer's sun-spot observations at Auclam from 1871 to 1879, in continuation of those for the years 1861 to 1870, previously published. From a comparison of the rotation-angles for 78 spots with the formula, Professor Spörer finds that the larger deviations are always towards the west, indicating that a descending current has brought down with it the larger velocity of the higher regions of the sun's atmosphere. The law previously deduced by Professor Spörer, that, about the time of minimum, spots commence to break out in high latitudes, and that the zone of disturbance gradually approaches the equator till at the next minimum it coincides with it and dies away, to be replaced by a new zone in high latitudes, is confirmed by the recently published Auclam results, comprising (with Carrington's series) two complete spot-cycles.

In astronomical photography an important advance has been made by the successful application of the new processes to the nebulæ as

well as to the comets. Professor Henry Draper and Mr. Common have obtained photographs of the great nebula in Orion, showing considerable detail, and Mr. Huggins and Professor Henry Draper have succeeded in photographing its spectrum. Mr. Huggins finds in his photograph a very strong bright line in the ultra-violet at wave-length 3730, in addition to the four nebular lines previously discovered by him in the visible portion. Professor H. Draper's photographs do not show this bright line, though they have faint traces of other lines in the violet, and he thinks that this may be due either to the circumstance that he had placed himself on a different part of the nebula or to his use of a refractor with glass prism, while Mr. Huggins used a reflector and Iceland spar prism. The most striking feature of Professor Draper's photographs is perhaps the discovery of two condensed portions of the nebula (just preceding the Trapezium) which give a continuous spectrum.

Professor Schiaparelli has recently called attention to a peculiar feature on the planet Mars. In 1877 he remarked a number of narrow dark lines, which he called "canals," connecting the dark spots or so-called "seas" of the southern and northern hemispheres. He now finds that these lines are each doubled, so that according to his view the equatorial regions of Mars are covered by a network of pairs of parallel straight lines. It is to be remarked that though the appearance of Mars as depicted by Professor Schiaparelli differs greatly from previous representations, indications of these double "canals" are to be found in the sketches of other observers.

The two bright comets of this year possess more than usual interest. The bright comet discovered at Boston by Wells, on March 18th, was the first comet since the spectroscope was applied to these objects, which presented a spectrum unlike the hydrocarbon type common to all the other comets which appeared since 1864. The eye observations, as well as its photographic spectrum (taken by Mr. Huggins), showed an absence of the hydrocarbon spectrum, which was replaced by a brilliant continuous spectrum and bright lines, including those of sodium.

In September, a very brilliant comet appeared near the sun. It seems to have been discovered independently by Ellery, at Melbourne, Finlay at the Cape, Mr. Common in this country, and also by Thollon and Cruls. This great comet has been a brilliant object in the early mornings during the past two months. On September 17th, an observation, apparently unique in the history of astronomy, was made by Mr. Gill at the Cape, who watched the comet right up to the sun's limb. It could not, however, be detected in the sun, and this circumstance of appearing neither bright nor dark when in front of the sun, appears to suggest a very small substantiality, or great separation of the cometary matter. After perihelion it presented a magnificent

appearance, having a tail 30° long, and even on October 30th, the tail covered a space greater than the mean distance of the earth from the sun.

On October 9th, Professor Schmidt discovered a nebulous object not far from the great comet, the orbit of which strongly suggests a connexion in the past with the great comet. This fact is of more interest when the orbits of the great comet of this year, of Comet I, 1880, and of the well-known comet of 1843 are compared. The very near approach of the great comet to the sun will lead astronomers to watch with great interest for its return to our system, whatever may be its destiny, to fall ultimately into the sun, or to disappear through a process of gradual disintegration. In the Astronomische Nachrichten, just published, Professor Pickering (one of whose assistants has computed the elements of the orbit of this comet), states, "I believe the deviation from a parabola to be real, although the corresponding period may be very long. These differences seem to indicate that the disturbance suffered by the comet in passing through the coronal region could not have been great."

This comet presented a spectrum similar to that of Comet Wells, but while receding from the sun, the bright lines of its spectrum became fainter, and then the usual hydrocarbon spectrum made its appearance. This observation, taken in connexion with those of the previous comet, suggests a modified condition of an essentially similar chemical constitution. The phenomena would admit more easily of explanation if the cometary light is supposed to be due to electric discharges, as it is well known how preferential is the electric discharge when several substances are present together in the gaseous form.

Before leaving this subject, I venture to quote the following passage from the "Observatory," which puts in a very clear form the speculations now current, on the relation of the present great comet to that of 1880, 1843, and possibly 1668.

"The physical appearance of the comet, which like that of 1843, and unlike that of 1880, showed at first a decided nucleus, together with the intimation of a period very considerably greater than that of the interval from 1880, January 27, the date of perihelion of the 1880 comet, suggest that perhaps the 1843 comet suffered disintegration when at its nearest approach, and that the 1880 comet was a portion of its less condensed material, whilst the body of the comet with the principal nucleus, suffering less retardation than the separated part, has taken two and a-half years longer to perform a revolution. The remarkable discovery made by Professor Schmidt, of Athens, on October 8, of a second comet only 4° S. W. of the great comet, and having the same motion, would seem to confirm this view."

The scientific year now concluded has not been so fertile as its predecessor in the initiation of great national and international under-

takings, neither have any of those larger enterprises which I took occasion to mention last year, such as the circumpolar observations, or the Transit of Venus Expeditions, as yet been brought to their final issue. Nevertheless, in some of them we have evidence that good work is already being done, and in the others, of which we have as yet no information, there is no reason to doubt that the same is the case. Nor again, in the border-land between science proper and its applications, have I to record anything so important as the Paris Electrical Exhibition. That Exhibition, however, bore legitimate fruit in the Electric Lighting Exhibition at the Crystal Palace, and in the technical experiments lately carried out on a large scale at Munich. Perhaps the most prominent feature of the Crystal Palace Show was the incandescent light. At Paris that mode of illumination appeared to be little more than a possibility, in London it had become an accomplished fact. The importance attaching to this advance in electric lighting may be measured both by the rapid extension of its use, and also by the fact that not a few of our leading minds consider that the incandescent lamp is the lamp of the future, not merely for domestic, but even for many other public purposes.

But in another way the present year has witnessed the most important step which could have been taken for the promotion of electric lighting in this country. The Legislature has passed the Electric Lighting Bill, and, so far as legislation can effect the object, it has brought electricity to our doors. Up to this time installations of greater or less magnitude had sprung up sporadically in many parts of the country, in railway stations, manufacturing works, and occasionally in private houses. But, compared with the lighting of a whole town, or even of separate districts of a large city, even the most important of these must be confessed still to partake of the nature of experiments; experiments, it is true, on a large scale, and, as I believe, conclusive as to the ultimate issue. Indeed, by multiplication of machines it is certainly, even now, possible to increase the lighting power to any required extent; but this can hardly be regarded as the final form of solution of the problem, inasmuch as such a method would be as uneconomical as it would be to use a number of small steam-engines instead of a large one. And when we consider that at the time of the passing of the Act in question, there was but one machine actually constructed which was capable of illuminating even one thousand incandescent lamps (I mean that of Edison), we cannot but feel that much remained to be done before the requirements of the public could be fully met. I do not mean thereby to imply that the Act was passed at all too soon; on the contrary, it has already given just that impetus which was necessary for producing installations on a larger scale. In illustration of this, I cannot help mentioning, as the first fruit of the impetus, a remarkable

machine, by our countryman Mr. J. E. H. Gordon, which appears capable of feeding from five to six thousand lamps.

But beside the impulse above described, the Bill will have a scientific influence perhaps not contemplated by its original promoters. Under this Act, for the first time in the history of the world, energy will come under the grasp of the law, will become the subject of commercial contracts, and be bought and sold as a commodity of everyday use. It is, in fact, far from improbable that the public supply of electricity will be reckoned and charged for in terms of energy itself. But whether this be literally the case or not, a measurement of energy must lie at the root of every scale of charge.

And, further, since the Act allows no restriction to be placed upon the use of the electricity so supplied, it follows that it may be used, and undoubtedly will be used, at the pleasure and convenience of the customer, either for lighting, or for heating, or for mechanical, or for chemical purposes. This being so, it is clear that the public must by this process become, practically at least, familiar with the various modes of the transformation of force; and the Act in question might, from this point of view, have been entitled An Act for the better Appreciation of the Transformation of Force.

While offering to the public this new commodity electricians may, in one respect, especially congratulate themselves, namely, that their article is incapable of adulteration. An electric current of a given strength and given electro-motive force is perfectly defined, and is identically the same whether it comes from a Siemens or a Gramme, from a magneto- or from a dynamo-machine; or, as was suggested by an eminent counsel before the Select Committee of the House of Commons, just as if it had been merely a question of coming from one machine painted red or from another painted blue.

It has been said, and perhaps with truth, that the electric light will be the light of the rich rather than that of the poor. But in more ways than one electricity may now become the poor man's friend. The advantages in avoidance of heat and of vitiated atmosphere in workshops and factories have often been pointed out, and may ultimately become an important factor in the physical growth and prosperity of our population. But besides this, when electricity is literally brought to our doors, it will become possible, by converting it into motive power of limited extent, to revive some of the small industries which during the last half century have been crushed by the great manufacturing establishments of the country. There are operations which are capable of being carried out by the wives and families of workmen; there are works of small extent which can be performed more advantageously in a small establishment than in a large one, and it can hardly fail to be a gain to the community if this new departure should give fresh opportunities for the development of our industry in these directions.

On the motion of Sir Charles Shadwell, seconded by Dr. Gilbert, it was resolved:—"That the thanks of the Society be returned to the President for his Address, and that he be requested to allow it to be printed."

The President then proceeded to the presentation of the Medals:—

The Copley Medal has been awarded to Professor Arthur Cayley, F.R.S., for his numerous profound and comprehensive researches in Pure Mathematics.

One Royal Medal has been awarded to Professor William Henry Flower, F.R.S. During the last thirty years Professor Flower has been actively engaged in extending our knowledge of Comparative Anatomy and Zoology in general and of the Mammalia in particular.

His Memoirs on the Brain and Dentition of the Marsupialia published in the "Phil. Trans." for 1865 and 1867, established several very important points in morphology, and finally disposed of sundry long-accepted errors.

His paper "On the Value of the Characters of the Base of the Cranium in the Carnivora" (1869), and numerous memoirs on the Cetacea, are hardly less valuable additions to zoological literature.

Professor Flower has been for more than twenty years Curator of the Museum of the Royal College of Surgeons, and it is very largely due to his incessant and well-directed labours that the museum at present contains the most complete, the best ordered, and the most accessible collection of materials for the study of vertebrate structure extant.

The publication of the first volume of the new Osteological Catalogue in 1879, affords an opportunity for the recognition of Professor Flower's services in this direction. It contains carefully verified measurements of between 1,300 and 1,400 human skulls, and renders accessible to every anthropologist a rich mine of cranological data.

The other Royal Medal has been awarded to Lord Rayleigh, M.A., F.R.S.

The researches of Lord Rayleigh have been numerous, and extend over many different subjects; and they are all characterised by a rare combination of experimental skill with mathematical attainments of the highest order.

One class of investigations to which Lord Rayleigh has paid much attention is that of vibrations, both of gases and of elastic solids. The results of most of these researches are now embodied in Lord Rayleigh's important work on the "Theory of Sound"—a work which not only presents the labours of others up to the time of writing in a digested and accessible form, but is full of original matter.

The subject of vibrations naturally leads on to a mention of other hydro-dynamical researches. Lord Rayleigh has investigated the motion of waves of finite height, and in particular has shown that the "great solitary wave" of our late Fellow, Mr. Scott Russell, has a determinate character; and he has investigated the circumstances of its motion to an order of approximation sufficient to apply to waves of considerable height.

Lord Rayleigh has examined more fully than had previously been done the theory of diffraction gratings, and the effects of irregularities; and also investigated the defining power of optical combinations, and its limitation by diffraction and spherical aberration.

He has lately been engaged in the elaborate re-determination of the B.A. unit of electrical resistance.

The Rumford Medal has been awarded to Captain W. de W. Abney, R.E., F.R.S. Captain Abney has contributed largely to the advancement of the theory and practice of photography by numerous investigations. In the Bakerian Lecture for 1880, he has given an account of a method by which photography can be extended to the invisible region below A, which had been hitherto but very imperfectly examined by means of the thermopile.

Making use of plates prepared with silver bromide in a particular molecular condition, Captain Abney, by means of a diffraction grating containing 17,600 lines to the inch, constructed a detailed map of the infra-red region of the solar spectrum extending from A down to λ 10,650 (Plate XXXI, "Phil. Trans.," 1880). The lowest limit of this map was fixed by conditions of the diffraction apparatus, and not by a falling-off of the sensitiveness of the plates at this low point; for, when a prismatic apparatus was used, photographs were obtained which show a continuous spectrum down as far as λ 12,000.

In a subsequent paper ("Phil. Trans.," 1881, p. 887), Captain Abney, working with Lieut.-Col. Festing, R.E., applied this new extension of photography to a research on the influence of the atomic grouping in the molecules of organic bodies on their absorption in the infra-red region of the spectrum. The authors believe that their results indicate, without much doubt, that the complex substances they examined can be grouped according to their absorption spectra, and that such grouping, as far as their experiments go, agrees on the whole with that adopted by chemists. They have more confidence in their results, as they were careful to select such bodies as might be regarded as typical; but, of course, much patient labour of many, for a long period, will be necessary before this new branch of physico-chemical research can be regarded as fully established in any complete form.

Captain Abney has since carried on his work in this new region of

the spectrum at different elevations during a recent visit to Switzerland.

The Davy Medal has been awarded to Dimitri Ivanovitch Mendeleeff and Lothar Meyer.

The attention of chemists had for many years past been directed to the relations between the atomic weights of the elements and their respective physical and chemical properties; and a considerable number of remarkable facts had been established by previous workers in this field of inquiry.

The labours of Mendeleeff and Lothar Meyer have generalised and extended our knowledge of those relations, and have laid the foundation of a general system of classification of the elements. They arrange the elements in the empirical order of their atomic weights, beginning with the lightest and proceeding step by step to the heaviest known elementary atom. After hydrogen the first fifteen terms of this series are the following, viz:—

Lithium	7	Sodium	23
Beryllium	9·4	Magnesium	24
Boron	11	Aluminium	27·4
Carbon	12	Silicon	28
Nitrogen	14	Phosphorus	31
Oxygen	16	Sulphur	32
Fluorine	19	Chlorine	35·5
		Potassium	39

No one who is acquainted with the most fundamental properties of these elements can fail to recognise the marvellous regularity with which the differences of property, distinguishing each of the first seven terms of this series from the next term, are reproduced in the next seven terms.

Such periodic re-appearance of analogous properties in the series of elements has been graphically illustrated in a very striking manner with respect to their physical properties, such as melting-points and atomic volumes. In the curve which represents the relations of atomic volumes and atomic weights analogous elements occupy very similar positions, and the same thing holds good in a striking manner with respect to the curve representing the relations of melting-points and atomic weights.

Like every great step in our knowledge of the order of nature, this periodic series not only enables us to see clearly much that we could not see before; it also raises new difficulties, and points to many problems which need investigation. It is certainly a most important extension of the science of chemistry.

The Statutes relating to the election of Council and Officers were then read, and Sir Henry Lefroy and Mr. Vaux having been, with the consent of the Society, nominated Scrutators, the votes of the Fellows present were taken, and the following were declared duly elected as Council and Officers for the ensuing year:—

President.—William Spottiswoode, M.A., D.C.L., LL.D.

Treasurer.—John Evans, D.C.L., LL.D.

Secretaries.— { Professor George Gabriel Stokes, M.A., D.C.L., LL.D.
Professor Michael Foster, M.A., M.D.

Foreign Secretary.—Professor Alexander William Williamson, Ph.D., LL.D.

Other Members of the Council.

Professor W. Grylls Adams, M.A.; John Ball, M.A.; Thomas Lauder Brunton, M.D., Sc.D.; Professor Heinrich Debus, Ph.D.; Francis Galton, M.A.; Professor Olaus Henrici, Ph.D.; Professor Thomas Henry Huxley, LL.D.; Professor E. Ray Lankester, M.A.; Professor Joseph Lister, M.D.; Professor Joseph Prestwich, M.A.; Professor Osborne Reynolds, M.A.; Professor Henry Enfield Roscoe, B.A., LL.D.; Marquis of Salisbury, K.G., M.A.; Osbert Salvin, M.A.; Warington W. Smyth, M.A., F.G.S.; Edward James Stone, M.A.

The thanks of the Society were given to the Scrutators.

The following Table shows the progress and present state of the Society with respect to the number of Fellows:—

	Patron and Royal.	Foreign.	Compounders.	£4 yearly.	£3 yearly.	Total.
Nov. 30, 1881 ..	4	50	227	214	39	534
Since Elected ..	+ 1		+ 6	+ 2	+ 11	20
Since Compounded			+ 1	− 1		
Since Deceased ..		− 4	− 12	− 7	− 1	− 24
Since Withdrawn				− 1		− 1
Defaulter ..				− 1		− 1
Nov. 30, 1882 ..	5	46	222	206	49	528

Statement of Receipts and Expenditure from November 26, 1881, to November 24, 1882.

	£	s.	d.
Annual Contributions, 212 at £4 ..... £848			
„ 51 at £3 153	1,001	0	0
Admission Fees	40	0	0
Fee Reduction Fund, in lieu of Admission Fees and Annual Contributions	195	0	0
Compositions	460	0	0
Rents	171	2	7
Dividends (exclusive of Trust Funds)	1,413	13	0
„ on Jodrell Fund	151	15	3
Interest on Mortgage Loan	587	10	0
Sale of Transactions and Proceedings	783	6	6
Donation from J. S. Budgett, Esq.	100	0	0
Sale of Land at Acton	32,207	13	7
Interest on Deposit £201 1 1			
163 15 0	364	16	1
	£37,475	17	0

	£	s.	d.	£	s.	d.
Salaries and Wages				1,061	13	0
The Library Catalogue				80	0	0
Books for the Library				170	16	10
Binding ditto				126	0	2
Printing Transactions, Part III. 1881, Part I. 1882, and Separate Copies to Authors and Publisher	311	18	8			
Ditto Proceedings, Nos. 215-221	390	17	10			
Ditto Miscellaneous	76	13	9	2,005	8	7
Paper for Transactions and Proceedings	295	6	6			
Binding ditto	79	0	3			
Engraving and Lithography	851	11	7			
Soirée and Reception Expenses				69	5	0
Coal, Lighting, &c.	76	12	8			
Office Expenses	19	16	8			
House Expenses	240	7	10			
Tea Expenses	19	19	11			
Fire Insurance	41	15	0	555	3	3
Taxes	33	5	10			
Advertising	16	9	0			
Postage, Parcels, and Petty Charges	31	8	5			
Miscellaneous Expenses	75	7	11			
Law Charges				13	19	8
Law Charges and Expenses, Acton Estate				160	4	2
Purchase of £1,000 Consols				1,003	15	0
„ £5,000 Madras Railway Guaranteed 5 % Stock				6,565	2	6
„ £5,000 North Eastern Railway 4½ % Stock, 1876				5,530	0	0
„ £5,000 London and North Western Railway Consolidated Preference Stock				5,593	1	2
Deposit with Bankers				13,217	13	7
„ „ Few and Co., on Purchase of Ground Rents				1,590	0	0
				£37,742	2	11

Trust Funds.

	£	*s.*	*d.*	£	*s.*	*d.*
Donation Fund Dividends	417	19	2			
Rumford Fund Dividends	68	4	10			
Wintringham Fund „	35	5	0			
Copley Medal Fund „	58	16	8	615	10	7
Davy Medal Fund „	32	6	2			
Croonian Lecture Fund—Rent from College of Physicians	2	18	9			
Balance at Bank, Dec., 1881	2,241	11	8	2,259	4	7
Do. on hand	17	12	11			
				£40,350	12	2

	£	*s.*	*d.*	£	*s.*	*d.*
Donation Fund	539	0	0			
Davy Medal Fund	32	6	0			
Wintringham Fund	35	2	0			
Copley Medal Fund	54	8	3	667	15	0
Bakerian Lecture	4	0	0			
Croonian Lecture	2	18	9			
Balance at Bank				1,929	0	0
Balances on hand, Catalogue Account				11	14	3
				£40,350	12	2

JOHN EVANS,
Treasurer.

Estate at Mablethorpe, Lincolnshire (55 A. 2 R. 2 P.), £110 per annum.
Fee Farm near Lewes, Sussex, rent £19 4*s.* per annum.
One-fifth of the clear rent of an estate at Lambeth Hill, from the College of Physicians, £3 per annum.
Stevenson Bequest. Chancery Dividend. One-fourth annual interest on £85,336, Government Annuities and Bank Stock (produced £509 1*s.* 9*d.* in 1881–82).

£21,000 { £14,952 12*s.* 3*d.* Reduced 3 per Cent. Annuities.
{ £6,047 7*s.* 9*d.* „ „ „ Handley Fund.

£15,000 Mortgage Loan, 4 per Cent.

£19,314 0*s.* 2*d.* Consolidated Bank Annuities, { being £15,861 19*s.* 1*d.* in name of the R. S., and £3,452 1*s.* 1*d.* in Chancery, arising from sale of the Coleman Street Estate.

£403 9*s.* 8*d.* New 2½ per Cent. Stock—Bakerian and Copley Medal Fund.

£11,511 6*s.* New Threes { £6,328 11s. 2*d.* Scientific Relief Fund.
{ 5,182 14*s.* 10*d.* Jodrell Fund.

£667 5*s.* 6*d.* India Fours.
£660 Madras Guaranteed 5 per Cent. Railway Stock.—Davy Medal Fund.
£10,000 Italian Irrigation Bonds.—The Gassiot Trust.
£1,396 Great Northern Railway 4 per Cent. Debentures—The Trevelyan Bequest.
£100 Metropolitan 3½ per Cent. Stock.—Scientific Relief Fund.
£1,550 „ „ —Fee Reduction Fund.
£7,000 London and North Western Railway 4 per Cent. Debentures. } „ „
Two Hundred Shares in the Whitworth Land Company, Limited. } „ „
£5,000 Madras Railway Guaranteed 5 °/₀ Stock.
£5,000 North Eastern Railway 4 °/₀ Stock.
£5,000 London and North Western Consolidated Preference Stock.

We, the Auditors of the Treasurer's Accounts on the part of the Council, have examined these Accounts and found them correct; and we find that the Balance at the Bankers' is £1,929 0*s.* 0*d.*

W. SPOTTISWOODE, *Pres.*
JAS. RISDON BENNETT.
ALEXANDER JOHN ELLIS.
JOSEPH LISTER.
G. G. STOKES, *Sec.*

We, the Auditors of the Treasurer's Accounts on the part of the Society, have examined these Accounts and found them correct; and we find that the Balance at the Bankers' is £1,929 0*s.* 0*d.*

J. T. BOILEAU.
W. H. M. CHRISTIE.
WARREN DE LA RUE.
G. MATTHEY.

Trust Funds. 1882.

Scientific Relief Fund.

	£	s.	d.
New 3 per Cent. Annuities	6,328	11	2
Metropolitan 3½ Consols	100	0	0
	£6,428	11	2

Dr. *Cr.*

	£	s.	d.		£	s.	d.
To Balance	85	2	3	By Grants	80	0	0
„ Dividends	188	16	0	„ Balance	193	18	3
	£273	18	3		£273	18	3

Donation Fund.

£6,339 0*s.* 1*d.* Consols.

The Trevelyan Bequest.

£1,396 Great Northern Railway 4 per Cent. Debentures.

	£	s.	d.		£	s.	d.
To Balance	792	12	1	By Grants	539	0	0
„ Dividends	240	17	8	„ Balance	671	11	3
„ Transferred from Handley Fund	177	1	6				
	£1,210	11	3		£1,210	11	3

Rumford Fund.

£2,322 19*s.* Consols.

	£	*s.*	*d.*		£	*s.*	*d.*
To Balance	67	19	0	By Balance	136	3	10
„ Dividends, 1882	68	4	10				
	£136	3	10		£136	3	10

Bakerian and Copley Medal Fund.

Sir Joseph Copley's Gift, £1,666 13*s.* 4*d.* Consols.
£403 9*s.* 8*d.* New 2½ per Cent.

	£	*s.*	*d.*		£	*s.*	*d.*
To Balance	102	4	1	By Gold Medal	4	8	3
„ Dividends	9	17	6	„ K. A. Wurtz, Sir J. Copley's Gift	50	0	0
„ Dividend—Sir J. Copley's Fund	48	19	2	„ Bakerian Lecture	4	0	0
				„ Balance	102	12	6
	£161	0	9		£161	0	9

The Keck Bequest.

£600 Midland Railway 4 per Cent. Debenture Stock.

	£	*s.*	*d.*		£	*s.*	*d.*
To Dividends, 1882	23	10	0	By Payment to Foreign Secretary	23	10	0

Wintringham Fund.

£1,200 Consols.

	£	*s.*	*d.*		£	*s.*	*d*
To Balance, 1881	35	2	0	By Payment to Foundling Hospital, 1882	35	2	0
„ Dividends, 1882	35	5	0	„ Balance	35	5	0
	£70	7	0		£70	7	0

Croonian Lecture Fund.

	£	s.	d.		£	s.	d.
To Balance, 1881	2	18	9	By Croonian Lecture	2	18	9
„ One-fifth of Rent of Estate at Lambeth Hill, payable by the College of Physicians	2	18	9	„ Balance	2	18	9
	£5	17	6		£5	17	6

Davy Medal Fund.

£660 Madras Guaranteed 5 per Cent. Railway Stock.

	£	s.	d.		£	s.	d.
To Balance	138	18	10	By Gold Medal	32	6	0
„ Dividends	32	6	2	„ Balance	138	19	0
	£171	5	0		£171	5	0

The Gassiot Trust.

£10,000 Italian Irrigation Bonds.
£200 3 per Cent. Consols.

	£	s.	d.		£	s.	d.
To Balance	157	0	9	By Payments to Kew Committee	496	14	6
„ Dividends	502	12	0	„ Balance	162	18	3
	£659	12	9		£659	12	9

Handley Fund.

£6,047 7*s.* 9*d.* Reduced.

	£	*s.*	*d.*		£	*s.*	*d.*
Dividends, 1882	177	1	6	By transferred to Donation Fund	177	1	6

The Jodrell Fund.

£5,182 14*s.* 10*d.* New 3 per Cent. Stock.

	£	*s.*	*d.*		£	*s.*	*d.*
To Dividends, 1882	151	15	3	By transferred to Royal Society General Account	151	15	3

Fee Reduction Fund.

£1,550 Metropolitan Consols 3½ per Cent.
£7,000 London and North Western Railway 4 per Cent. Debentures.
Two Hundred Shares in the Whitworth Land Company, Limited.

	£	*s.*	*d.*		£	*s.*	*d.*
To Balance (1881)	48	18	4	By transferred to Royal Society General Account (1882)	195	0	0
„ Dividends	444	19	1	„ Balance	298	17	5
	£493	17	5		£493	17	5

Account of the appropriation of the sum of £4,000 (the Government Grant) annually voted by Parliament to the Royal Society, to be employed in aiding the Advancement of Science (continued from Vol. XXXIII, p. 76.)

1882.

	£	*s.*	*d.*
A. Macfarlane, for a Quantitative Research on the Conditions of Discharge of Electricity of high Potential.....	25	0	0
H. S. Hele Shaw, for the construction of an Improved Anemometer; three diagrams and photograph.....	50	0	0
B. Stewart, for the expense of an Assistant in investigating the Inequalities of Sun-spots, and their Terrestrial Effects	80	0	0
J. N. Lockyer, for Spectroscopic Researches in connexion with the Spectrum of the Sun.....	100	0	0
Thos. and Andrew Gray, for continuation of Experiments on the Specific Resistance and Specific Inductive Capacity of different kinds of Glass.....	50	0	0
J. Kerr, for continuation of Experiments in Electro- and Magneto-Optics.....	50	0	0
Prof. W. N. Hartley, for continuation of Researches on Ultra-Violet Spectra	150	0	0
H. Tomlinson, for Investigations on the Influence of Stress and Strain on the Action of Physical Forces.....	50	0	0
T. Stevenson, for the Reduction and Discussion of Meteorological Observations made from June to October, 1881, at Fort William and on the top of Ben Nevis.....	50	0	0
E. Neison, for continuation of Computations in the Lunar Theory	50	0	0
Prof. G. D. Liveing, for defraying the cost of Apparatus and Material used by him in Spectroscopic Researches....	200	0	0
C. Michie Smith, for Spectroscope and Apparatus suitable for observing and photographing the Spectrum of the Zodiacal Light	50	0	0
C. Michie Smith, for an Electrometer for observing Atmospheric Electricity	20	0	0
A. Mallock, for continuing his experiments on the ruling of large Diffraction-gratings	120	0	0
G. F. Rodwell, for the construction of an Apparatus for determining with accuracy the Coefficients of Expansion			
Carried forward.....	£1,045	0	0

Brought forward	£1,045	0	0
and Contraction of Bodies at temperatures far exceeding 100° C.	88	10	0
G. R. Vine, for further Investigation of the Morphological Structures of the Organisms found in the Wenlock Shales	25	0	0
Dr. C. Callaway, for continuation of Investigations of the Relation between the newer Gneissic Series of the Highlands and the Fossiliferous Ardovician Group	50	0	0
Rev. O. P. Cambridge, for Investigation, under high Microscopic Power, of the Palpi, Palpal Organs, and other Genital Parts and Processes, external and internal, of Spiders and other Arachnidæ	25	0	0
Prof. W. C. Williamson, for extension of the Research into the Fossil Plants of the Coal-Measures to a Systematic Study of the Microscopic Aspects of the chief Coals from all the Coal-Fields of the World	50	0	0
E. C. Rye, in aid of the Publication Fund of the Zoological Record Association	150	0	0
Dr. R. Braithwaite, for aid in Publishing a Work on the British Moss Flora	50	0	0
G. E. Dobson, for continuation of his illustrated Monograph on the Anatomical Structure, Systematic Position, and Geographical Distribution of the Species of the Order Insectivora	100	0	0
W. Topley (in instalments), for the Preparation and Publication of a Geological Map of Europe, and the adjacent parts of Asia and Africa, under the authority of the International Geological Congress	150	0	0
Dr. J. Hamilton, for continuation of Researches on Topographical Anatomy of the Brain	75	0	0
Dr. Ferrier, for the purchase of Monkeys and other Animals to be used in an Experimental Investigation of some points in the Physiology of the Brain and Spinal Cord	50	0	0
Chas. Roy, for the construction of Apparatus for photographing the Movements of a Lippmann's Galvanometer	35	0	0
Prof. J. Struthers, for the expense of Investigations into the Anatomy of the Greenland Right Whale	25	0	0
Rev. A. E. Eaton, to defray further the cost of printing and publishing a descriptive Monograph of the Ephemeridæ	100	0	0
Carried forward	£2,018	10	0

Brought forward	£2,018	10	0
E. A. Letts, for Materials and Assistance required in Experiments on the Organic Compounds of Phosphorus and Sulphur	40	0	0
L. T. Thorne, for Investigation of the Character and Mode of Formation of an Anhydrous Substance obtained by the Distillation of Ethylacetopropionic Acid	30	0	0
H. B. Dixon, for aid in a Research on the Phenomena of the Combustion of Gases in closed Vessels	150	0	0
Prof. J. S. Humpidge, for the expense of Materials and Apparatus to be employed in the extraction of metallic Glucinum in the compact form, and for Investigations of the Metal, if obtained	50	0	0
C. Schorlemmer, for continuation of researches into (1) Aurin; (2) the Normal Paraffins; (3) Suberone	100	0	0
Profs. Tilden and Shenstone, for assistance in continuing a research into the Constitution of Solutions and the Phenomena of Supersaturation and Superfusion	50	0	0
Dr. B. Brauner, to defray the cost of a Platinum Tube and other Platinum Apparatus for Investigation of the Anhydrous Fluorides by a new Method	30	0	0
Prof. M. F. Heddle, for continuation of a Research connected with the Scientific Mineralogy and Geognosy of Scotland—£100 for analyses, £100 personal	100	0	0
Spencer U. Pickering, for continuation of a Research into Molecular Combinations	50	0	0
W. Saville Kent, for a renewal of former grant to aid him in a further Investigation of the Protozoa and allied Organisms	100	0	0
C. Lapworth, for assistance in Studying the detailed Geology of the Lower Palæozoic Rocks of Britain, and describing the Graptolites they contain	150	0	0
Prof. W. K. Parker, for assistance in his Researches into the Morphology of the Vertebrata, more especially of the Skull	300	0	0
	£3,168	10	0

Dr.

	£	*s.*	*d.*
To Balance on hand, Nov. 30, 1881	1,446	6	3
To Balance of Administrative Expenses	20	1	1
Interest on Deposit	22	7	0
Moiety of Treasury Grant	2,000	0	0
	£3,488	14	4

Dec. 1, 1882.
To Balance, and Moiety receivable from the Treasury £2,260 13 7

Cr.

	£	*s.*	*d.*
By Appropriations, as above	3,168	10	0
Printing, Postage, Advertising, and other Administrative Expenses	59	10	9
Balance on hand, Nov. 30, 1882	260	13	7
	£3,488	14	4

Account of Grants from the Donation Fund in 1881–82.

Silvanus P. Thompson, for the cost of Experiments in the construction of Polarising Prisms of large aperture (of angle) £12

D. Mackintosh, for a Systematic Series of Observations in North Wales on the Positions of Boulders, relatively to the Forms of the Natural Surfaces on which they rest, with a view to throw light on the approximate date of the final disappearance of Glaciers and Floating Ice 7

Dr. A. Downes, to study further the Influence of Light on low forms of Life, with especial reference to (1) the Behaviour of such Organisms in various Media; (2) the question of their Destruction, or reduction to a state of dormant Vitality, by Light 10

Profs. Reinold and Rücker, for continuation, with improved Apparatus, of Researches on the Electrical Properties of Thin Films 30

J. N. Langley, for Observations on the Changes which take place in the Cells of the Liver during Secretion; and Observations on the Liver, and on the Gastric Glands of Birds during Digestion 30

E. D. Archibald, for experimental Researches into the Physics of the Atmosphere and its Meteorology by means of Kites 20

Carried forward £109

Brought forward.....	£109
R. Etheridge, Jun., and P. H. Carpenter, for aid in the further preparation of their Monograph of the Blastoidea, especially of British species, with their Morphology	30
Dr. De Burgh Birch, for a Microscopical Research into the Growth of Bone	10
A. M. Worthington, for Apparatus for measuring Photographs of Pendent Drops, and for investigating the influence of Electrical Charge on Surface Tension.....	20
W. T. Dyer, for aid in preparation of an Illustrated Monograph of Cycadæa.....	20
	£189