November 30, 1878.

ANNIVERSARY MEETING.

Sir JOSEPH HOOKER, C.B., K.C.S.I., President, in the Chair.

General Boileau, for the Auditors of the Treasurer's Accounts on the part of the Society, reported that the total ordinary receipts during the past year, including a balance of £933 11*s.* 1*d.* carried from the preceding year, amount to £5,924 5*s.* 9*d.*, and that the total ordinary expenditure in the same period amounts to £5,008 1*s.* 2*d.*, leaving a balance at the Bankers of £894 2*s.* 3*d.*, and £22 2*s.* 4*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.

Admiral Sir George Back, D.C.L.
Edward Blackett Beaumont.
Rev. James Booth, LL.D.
Lieut.-General John Cameron, R.E., C.B.
Frederick, Lord Chelmsford, D.C.L.
Rev. William B. Clarke, M.A.
Thomas Grubb, M.R.I.A.
Right Hon. Russell Gurney, Q.C.
Rear-Admiral Sir William Hutcheon Hall, K.C.B.
Prof. Robert Harkness, F.G.S.
John Hilton, F.R.C.S.
Cuthbert William Johnson.
Rev. Robert Main, M.A.
Colonel Thomas George Montgomerie, R.E.
Thomas Oldham, M.A., LL.D.
John Penn.
John, Earl Russell, K.G.
Very Rev. Augustus Page Saunders, D.D., Dean of Peterborough.
William Stokes, M.D., D.C.L.
Thomas Thomson, M.D.
Major-General Sir Andrew Scott Waugh, R.E.

On the Foreign List.

Antoine César Becquerel.
Claude Bernard.
Elias Magnus Fries.
Henri Victor Regnault.
Angelo Secchi.
Ernst Heinrich Weber.

Fellows elected since the last Anniversary.

John Gilbert Baker, F.L.S.	John Hopkinson, M.A., D.Sc.
Francis Maitland Balfour, M.A.	John Hughlings Jackson, M.D.
Rev. Thomas George Bonney, M.A.	Lord Lindsay, P.R.A.S.
Prof. James Henry Cotterill, M.A.	Samuel Roberts, M.A.
Sir Walter Elliot, K.C.S.I.	Edward A. Schäfer, M.R.C.S.
Rev. Canon W. Greenwell, M.A.	Right Hon. William Henry Smith.
Right Hon. Sir William Henry Gregory, K.C.M.G.	Hermann Sprengel, Ph.D.
	George James Symons.
Thomas Hawksley, C.E.	Charles S. Tomes, M.A.

On the Foreign List.

Marcellin Berthelot.	Adolph Wilhelm Hermann Kolbe.
Joseph Decaisne.	Rudolph Leuckart.
Emil Du Bois Reymond.	Simon Newcomb.

Pafnutij Tchebitchef.

The President then addressed the Society as follows :—

GENTLEMEN,

AT the conclusion of this, the fifth and last year during which I shall have held the most honorable office of your President, I have the gratifying assurance that the communications made to the Society and its publications have in no respect fallen off in scientific interest and value. We have not, indeed, been called upon to undertake during the past year such responsible and time-absorbing duties in behalf of the Government as the Polar, Circumnavigation, Transit of Venus, and other Committees demanded of us during the previous four years; but some of the results already achieved by those expeditions have been contributed to our publications, and we are in expectation of more. It is also with satisfaction that I can refer to the good attendance at our evening meetings, soirées, and réunions as evidence of the interest taken in our proceedings by the Fellows generally and their friends.

Before proceeding to touch upon some of the advances made in Science during the last few years, I have, as heretofore, to inform you of the Society's condition and prospects, and of those duties undertaken by its Council, for information as to which non-resident Fellows look to the annual address.

The loss by death of Fellows, twenty-one in number, is but little short of last year's rate, while that of Foreign Fellows (six) is twice as great as last year. On the home list is Sir George Back, the last, with

the exception of our former President, the venerable Sir E. Sabine, of that celebrated band of Arctic voyagers, which during the early part of the century added so much to our renown as navigators and discoverers. Sir George was further the companion of Franklin and Richardson in that overland journey to the American Polar Sea, in which human endurance was tried to the uttermost compatible with human existence, as is related by two of the party in that modest but thrilling narrative which will ever hold a unique place in the annals of geographical discovery. Of our Indian explorers four have been taken away, namely, Major-General Sir Andrew Waugh, for many years Director of the Great Trigonometrical Survey of India; and shortly afterwards his friend, Col. Montgomerie; Dr. Oldham, for a quarter of a century the Director of the Geological Society of India; and Dr. Thomas Thomson, my fellow-traveller in the Himalaya, whose report of explorations in Western Tibet contains the first connected account of the physical and natural features of that remote and difficult country. Lieut.-General Cameron survived but for one year our late Fellow, Sir Henry James, his predecessor in the Direction of the Ordnance Survey of Great Britain. In the Rev. James Booth we have lost a mathematician of high attainments. The Rev. W. B. Clarke, of New South Wales, was the author of many papers on the Meteorology and Geology of the Cape of Good Hope, Australia, and the Pacific. The Rev. R. Main, Director of the Radcliffe Observatory, was for nearly half a century an indefatigable observer. Lastly, Earl Russell, the distinguished statesman, and the earnest advocate, whether in the Government or in Parliament, of every measure for the promotion of scientific inquiry. He it was who, when Prime Minister in 1849, wrote to the then Earl of Rosse, President of the Society, offering to place £1,000 (now known as the Government Grant) on the annual votes of Parliament, if the Council would undertake to apportion that sum among scientific workers requiring aid in their researches.

Of Foreign Fellows our losses are a great Chemist in Becquerel, of Paris, whose election took place upwards of forty years ago; a great Physiologist in Claude Bernard, also of Paris; the father of Mycology, and for long the patriarch of Scandinavian Botanists, Elias Fries; a most distinguished Physicist and the recipient of both a Rumford and Copley medal in Regnault; a veteran Anatomist in Weber; and in Secchi, of Rome, an Astronomer of astonishing activity, the author of more than three hundred separate contributions to the science of which he was so great an ornament.

In matters of Finance I may with satisfaction refer you to our Treasurer's Balance Sheets.

It will be in your recollection that Mr. T. J. Phillips Jodrell placed in 1874 a sum of £6,000 at the disposal of the Society, with the view

of its being devoted to the encouragement of Scientific Research by periodical grants to investigators whom your Council might think it expedient thus to aid. Shortly after the receipt of this munificent gift, the Government announced its intention of devoting annually for five years £4,000 to the same object, thus anticipating the special purpose which Mr. Jodrell had in view. Thereupon, with his consent, the donation was temporarily funded and the proceeds applied to the general purposes of the Society until some other scheme for its appropriation should be approved. In April last I received a further communication from Mr. Jodrell, declaring it to be his wish and intention that, subject to any appropriation of the sum which we might, with the approval of the Society, make during his lifetime, it should immediately on his death be incorporated with the Donation Fund, the annual income in the meantime going to the general revenue of the Society. Upon this subject I have now to state that since the receipt of that letter Mr. Jodrell has approved of £1,000 of the sum being contributed to a fund presently to be mentioned.

I have also to inform you of a cheque for £1,000 having been placed in my hands by our Fellow, Mr. James Young, of Kelly, to be expended in the interests of the Society in such manner as I should approve.

Mr. De La Rue, to whose beautiful experiments I shall have occasion to refer, has presented to the Society both the letterpress and the exquisitely engraved fac-similes of the electric discharges described in his and Dr. Hugo Müller's paper, recently published in our "Transactions."

Our Fellow, Dr. Bigsby, has presented seven copies of his "Thesaurus Devonico-carboniferus" for distribution, and they have been distributed accordingly.

A very valuable addition to our Gallery of deceased Fellows has been the gift by Mr. Leonard Lyell of a copy in marble by Theed of the bust of his uncle the late Sir Charles Lyell, F.R.S., together with a pedestal. This is the best likeness of the late eminent geologist that has been executed, and is in every respect a satisfactory one.

I have the gratification of announcing to you, that through the munificence of a small number of Fellows, means have been advanced for reducing the fees to which all ordinary Fellows in future elected will be liable. That these fees, though not higher than the most economical expenditure on the part of the Society for its special purposes demanded, were higher than it was expedient to maintain if any possible means for reducing them could be obtained, was not only my own opinion but that of many Fellows. They exceed those of any other scientific society in England or abroad; their amount has

occasionally prevented men of great merit from having their names brought forward as candidates, and they press heavily, especially upon those who, with limited incomes, have other scientific societies to subscribe to. Nor does it appear to me as otherwise than regrettable that so high an honour as Fellowship of the Royal Society, the only one of the kind in England that is limited as to the number annually elected, and selective in principle, should be attainable only at a heavy pecuniary expenditure. It is true that our Fellows receive annually in return publications of great value to Science generally; but these treat of so many branches of knowledge that it is but a fraction of each that can materially benefit the recipient, while their bulk entails an additional expenditure; and now that the individual papers published in the "Transactions" are separately obtainable, the advantages of Fellowship are less than they were when to obtain a treatise on his own subject a specialist had either to join the Society, or to purchase a whole volume or a large part of it annually.

It was not, however, till I had satisfied myself that the annual income of the Society, though not ample, was sufficient for its ordinary purposes, that its prospects in other points of view were good, and that the expenditure upon publication was the main, if not the sole, obstacle to a reduction of fees, that I consulted your Treasurer on the subject of taking steps to attain this object.

My first idea was to create, by contributions of small amount, a fund the interest of which should be allowed to accumulate; and when the income of the accumulated capital reached a sufficient amount to enable the Society to take the step without loss of income, to reduce either the entrance fee or annual contribution; and to which fund Mr. Young's gift should be regarded as the first donation.

This proposal was in so far entertained by your Council that they resolved to establish a Publication Fund, and to place Mr. Young's gift to the credit thereof; and further, appointed a Committee to consider and report upon the Statutes of the Society concerning the fees.

The movement once set on foot met with an unexpectedly enthusiastic reception, several Fellows with the best means of forming a judgment, not only approved of it, but offered liberal aid, urging that the reduction of fees should be the first and immediate object, and that if such a course were thought desirable, the means of carrying it out would surely be forthcoming. On this your Treasurer prepared for my consideration a plan for raising £10,000, the sum required for effecting any material reduction; and we resolved to ascertain by private inquiry whether so large an amount could be obtained.

Here again our inquiries were responded to in a spirit of, I may say, unexampled liberality: in a few weeks upwards of £8,000 was given

or promised by twenty Fellows of the Society, and I need hardly add that the remaining £2,000 was contributed very shortly afterwards.

At a subsequent meeting of the Council it was resolved:—

1.—That the sums referred to as the Publication Fund, as well as those received or that may be hereafter received, for the purpose of relieving future ordinary Fellows from the Entrance Fee, and for reducing their Annual Contribution, be formed into one fund.

2.—That the Entrance Fee for ordinary Fellows be henceforth abolished; and that the Annual Contribution for ordinary Fellows hereafter elected be £3 (three pounds). Also, that the income of the Fund above-mentioned be applied, so far as is requisite, to make up the loss to the Society arising from these remissions and reductions.

3.—That the account of this Fund be kept separate; and that the annual surplus of income, after providing for the remission and reduction above recommended, be re-invested, until the income from the Fund reaches £600. So soon as the annual income reaches this amount, any surplus of income in any year, after providing for the remission and reduction above-mentioned, shall be available, in the first instance, in aid of publication and for the promotion of research.

A list of subscribers to this Fund will be placed in the hands of every Fellow, with the information that it will be kept open for future contributions, in the interests of research and of the Society's publications. I hope that it will be largely and speedily augmented, and that it may eventually reach an amount which will provide us with the means of accomplishing as much as is effected by the Government Fund, upon our own sole and undivided responsibility. I must not conclude my notice of this movement without a mention of those whose encouragement and liberality have most largely promoted it; and first of all, Mr. Spottiswoode, to whose counsel and active co-operation throughout, its success is mainly due; Messrs. Young's and Jodrell's contributions have already been mentioned, they have been supported by others:—£2,000 from Sir Joseph Whitworth, £1,000 from Sir W. Armstrong, and £500 each from His Grace the Duke of Devonshire, Mr. De La Rue, Mr. Spottiswoode and Mr. Eyre (jointly), Dr. Siemens, and the Earl of Derby, and £250 from Dr. Gladstone. The balance comprises contributions by thirty-two Fellows.

I have to mention your obligations to Dr. W. Farr for the labour he has bestowed in ascertaining those vital and other statistics of the Society, upon an accurate knowledge of which the calculations for the reduction of fees had to be based; and to Mr. Bramwell for constructing a table showing to what extent these changes will affect the

Society's present and future income. It may interest you to know that the contribution of ordinary Fellows in future to be elected, is but little over that which was required of all Fellows from the very commencement of the Society's existence till 1823, namely, 1*s.* per week, and that the last Fellows who paid that sum died in 1869.

Looking back over the five years during which I have occupied this chair, I recognise advances in scientific discovery and research at home and abroad far greater than any previous semi-decade can show. I do not here allude to such inventions as the Telephone, Phonograph, and Microphone, wonderful as they are, and promising immediate results of great importance to the community; nor even to those outcomes of high attainments, the Harmonic Analyser of Sir W. Thomson, and the Bathometer and Gravitation Meter of Siemens; but to those discoveries and advances which appeal to the seeker of knowledge for its own sake, whether as developing principles, suggesting new fields of research, or awakening attention to hitherto unseen or unrecognised, or unexplained phenomena of nature, and of which the Radiometer and Otheoscope of Crookes are conspicuous examples.

In the foremost rank as regards the magnitude of the undertakings and the combination of means to carry them out, nothing in the history of physical science can compare with the Transit of Venus Expeditions. To observe the Transit of Venus various nations of Europe and the United States competed as to the completeness of the Expeditions they severally equipped. The value* of the solar parallax cannot be ascertained until the results of all the Expeditions are taken into account, when it will have an international claim to acceptance. But advances in this direction will not have ended here, the very difficulties attending the observation of the Transit of Venus, having directed attention to the method originally suggested by the Astronomer Royal in 1857, of obtaining the solar parallax from the diurnal parallax of Mars at its opposition.

Mr. Gill by the skilful employment at Ascension Island of the heliometer lent by Lord Lindsay, has greatly increased the accuracy of the method by which the necessary star comparisons with Mars are made, and there is every reason to believe that the results of his observations which are now in course of reduction will be very satisfactory.

Within the last two years a remarkable addition has been made to

* The Astronomer Royal informs me that Captain Tupman, who has taken the principal share in the superintendence of the calculation, fixes provisionally on a mean parallax of 8″·8455, corresponding to a distance of 92,400,000 British miles, but that the observations would be fairly satisfied by any parallax between 8″·82 and 8″·88, which in distance produces a range of from 92,044,000 and 92,770,000 miles, differing by 726,000 miles, a quantity almost equal to the sun's diameter.

the number of members of the solar system by Professor Asaph Hall's discovery of the satellites of Mars; and more recently, Professor Watson has announced his detection of planetary bodies within the orbit of Mercury, during the Solar Eclipse which was visible in America.

In 1876 Schmidt recorded an outburst of light in a star in Cygnus, which showed a continuous spectrum containing bright lines similar to those of the remarkable star of 1866. As the star waned the continuous spectrum and bright lines faded, all but one bright line in the green, giving the object the spectroscopic appearance of a small gaseous nebula.

Great progress has been made during the last five years at Greenwich in the method of determining the motions of the heavenly bodies by the displacement of the lines in their spectra, as first successfully accomplished by Mr. Huggins in 1868. Not only do the results obtained by the stars observed at Greenwich agree with those of Mr. Huggins, as satisfactorily as can be expected in so delicate an investigation, but the motions of seventeen more have been determined; while the trustworthiness of the method has been shown by the agreement of the values for the rotation of the sun and the motions of Venus, with the known movements of these bodies. Mr. Huggins has also obtained photographs of the spectra of some of the brighter stars, which give well defined lines in the violet and ultra-violet parts of the spectrum. These spectra have already shown alterations in the lines common to them and the sun, which are of much interest.

In Solar Physics, which afford remarkable evidence of Mr. Lockyer's energetic labours in this country and Mr. Janssen's in France, I must mention our Foreign Member's wonderful photographs of the sun, wherein the minutest of the constant changes in the granulations exhibited on its surface (and which vary in size from $\frac{1}{10}$ of a second to 3 or 4 seconds) can be studied in future from hour to hour and day to day; as can also their different behaviour at different periods of the occurrence of sun-spots.

Before dismissing this fruitful field of research, I must allude to Mr. Lockyer's discovery of carbon in the sun; and to his announced but not yet published observations on the changes and modifications of spectra under different conditions, some of which he even regards as indicating the breaking up of the atoms of bodies hitherto regarded as elementary.

Some important investigations on the Electric Discharge have been communicated to the Society by Messrs. De La Rue and Müller, and by Mr. Spottiswoode. These, prosecuted by different means, tend to limit the possible causes of the stratification observed in discharges through vacuum tubes. They also point to the conclusion that this

phenomenon is in a great measure due to motions among the molecules of the residual gas, which themselves become vehicles for the transmission of Electricity through the tube. It is well known that gases at atmospheric pressure offer great resistance to the passage of Electricity; and that this resistance diminishes (to a certain limit, different for different gases) with the pressure. And the researches in question appear to show that the discharge, manifestly disruptive at the higher pressures, is really also disruptive even at pressures when stratification takes place. The period of these discontinuous discharges has not yet been the subject of measurement, but it must, in any case, be extremely rapid.

The remarkable experiments which have resulted in the liquefaction of the gases hitherto regarded as permanent will be noticed presently when I deliver to their authors the medals they so richly deserve.

Under the auspices of the Elder Brethren of the Trinity House, and as their scientific adviser, Professor Tyndall has conducted an investigation on the acoustic properties of the atmosphere. The instruments employed included steam whistles, trumpets, steam syrens, and guns. The propagation of sound through fog was proved to depend not upon the suspended aqueous particles, but upon the condition of the sustaining air. And as air of great homogeneity is the usual associate of fog, such a medium is often astonishingly transparent to sound. Hail, rain, snow, and ordinary misty weather, were also proved to offer no sensible obstruction to the passage of sound. Every phenomenon observed upon the large scale was afterwards reproduced experimentally. Clouds, fumes, and artificial showers of rain, hail, and snow were proved quite ineffectual to stop the sound, so long as the air was homogeneous, while the introduction of a couple of burners into a space filled with acoustically transparent air soon rendered it impervious to the waves of sound. As long as the continuity of the air in their interstices was preserved, the sound-waves passed freely through silk, flannel, green baize, even through masses of hard felt half an inch in thickness, the same sound-waves being intercepted by goldbeater's skin. A cambric handkerchief which, when dry, offered no impediment to their passage, when dipped into water became an impassable barrier to the sound-waves.

Echoes of extraordinary intensity were sent back from non-homogeneous transparent air; while similar echoes were afterwards obtained from the air of the laboratory, rendered non-homogeneous by artificial means. Detached masses of non-homogeneous air often drift through the atmosphere, as clouds pass over the face of the sky. This has been proved by the fluctuations observed with bells having their clappers adjusted mechanically, so as to give a uniform stroke. The fluctuations occur only on certain days; they occur when care has been taken to perfectly damp the bell between every two suc-

ceeding strokes; and they also occur when the direction of the sound is at right angles to that of the wind. Numerous observations were also made on the influence of the wind, the results obtained by previous observers being thereby confirmed. From his own observations, as well as from the antecedent ones of Mr. Alexander Beazeley and Professor Osborne Reynolds, Professor Tyndall concludes that the explanation of this phenomenon given by Professor Stokes is the true one.

Turning now to biological branches of Science, I find that the discoveries and researches of the past five years in this department also are far in advance of those of any previous period of equal length. The "Challenger" Expedition was, in point of the magnitude of the undertaking and completeness of its equipment, the rival of that for observing the Transit of Venus. Its general results, as far as hitherto made known, have been dwelt upon in my previous addresses, and the publication of them in detail is being rapidly pushed forward. Some very important papers by Mr. Moseley on the Corals collected on the voyage have indeed been published in our "Transactions" with admirable illustrations by himself.

To the Botanist and Geologist no subject has a greater interest than that of the conditions under which the successive Floras, which inhabited the polar area, existed and were successively dispersed over lower latitudes previous to their extinction, some *in toto* and over the whole globe, while others, though extinct in the regions where they once flourished, exist now only in lower latitudes under identical or under representative forms. It is only during the last few years that, thanks to the labours of those engaged in systematic Botany in tracing accurately the directions of migrations of existing genera and species, and in determining the affinities of the extinct ones, and of Palæontologists in referring the latter to their respective geological horizons, that any material advance has been made towards a knowledge of the origin and distribution of earlier and later Floras. I cannot better illustrate the condition of this inquiry than by calling your attention to two publications on the subject, which have appeared within the last few months.

As a contribution to the principles of Geographical Botany, Count Gaston de Saporta's essay, entitled "L'Ancienne Végétation Polaire" (which appeared in the "Comptes Rendus" of the French International Geographical Congress) is a very suggestive one, and having regard especially to its author's eminence as a geologist and palæontologist, is sure to command attentive study. Although it may be argued that neither is solar nor terrestrial physics, nor Geology, nor Palæontology in a sufficiently advanced condition to warrant the acceptation as fully established truths of all the conclusions therein advanced, still the array of facts adduced in evidence of these conclusions is very im-

posing, while the ability and adroitness with which they are brought to bear on the subject are almost worthy of the great French genius whose speculations form the starting-point of the theory, which is that life appeared first in the northern circumpolar area of the globe, and that this was the birthplace of the first and of all subsequent Floras.

I should premise that Count Saporta professedly bases his speculations upon the labours of his friend, Professor Heer, whose reasonings and speculations he ever puts forward with generous appreciation, while differing from him wholly on the subject of evolution, of which he is an uncompromising supporter; Professor Heer holding to the doctrine of the sporadic creation of species.

In his "Epoques de la Nature" Buffon argues that the cooling of the globe, having been a gradual process, the polar regions must have been the first in which the heat was sufficiently moderate for life to appear upon it; that other regions being as yet too hot to give origin to organised beings, a long period must have elapsed, during which the northern regions, being no longer incandescent, as they and all others originally were, must have had the same temperature as the tropical regions now possess.

Starting from this thesis, Count Saporta proceeds to assume that the termination of the Azoic period coincided with a cooling of the water to the point at which the coagulation of albumen does not take place; and that then organic life appeared, not in contact with the atmosphere, but in the water itself. Not only does he regard life as originating, if not at the North Pole, at least near to it, but he holds that for a long period life was active and reproductive only there. In evidence of this he cites various geological facts, as that the older, and at the same time the richest, fosilliferous beds are found in the cool latitudes of the North, namely in lats. 50° to 60°, and beyond them. It is in the North, he says, that Silurian formations occur, and though they extend as far south as lat. 35° N. in Spain and America, the most characteristic beds are found in Bohemia, England, Scandinavia, and the United States. The Laurentian rocks again, he says, reach their highest development in Canada, and Palæozoic rocks cover a considerable polar area north of the American great lakes, and appear in the coasts of Baffin's Bay, and in parts of Greenland and Spitzbergen. It is the same with the Upper Devonian and marine carboniferous beds preceding the coal formations; these extend to 76° N. in the polar islands and in Greenland, and to 79° N. in Spitzbergen, and he adds that M. d'Archiac has long ago remarked that, though so continuous to the northward, the coal-beds become exceptional to the southward of 35° N. Hence Count Saporta concludes that the climatic conditions favourable to the formation of coal were not everywhere prevalent on the globe, for that while the southern limit of this forma-

tion may be approximately drawn, its northern must have extended to the Pole itself.

I pass over Saporta's speculations regarding the initial conditions of terrestrial life, which followed upon the emergence of the earlier stratified rocks from the Polar Ocean, and proceed to his discussion of the climate of the carboniferous epoch as indicated by the characters of its vegetation, and of the conditions under which alone he conceives this can have flourished in latitudes now continuously deprived of solar light throughout many months of the year. In the first place, he accepts Heer's conclusions (founded on the presence of a tree-fern in the coal measures specifically similar to an existing tropical one), that the climate was warm, moist, and equable, and continuously so over the whole globe, without distinction of latitude. This leads him to ask whether, when the polar regions were inhabited by the same species as Europe itself, they could have been exposed to conditions which turned their summers into a day of many months' duration, and their winters into a night of proportional length?

A temperature so equable throughout the year as to favour a rich growth of Cryptogamic plants, appears, he says, to be at first sight incompatible with such alternating conditions as a winter of one long night and a summer of one long day; but equability, even in high latitudes, may be produced by the effect of fogs due to southerly warm oceanic currents, such as bathe the Orkneys and even Bear Island (in lat. 75° N.), and render their summers cool and winters mild. To the direct effects of these he would add the action of such fogs in obstructing terrestrial radiation, and hence preventing the evil effects which its cold would otherwise induce; and he would further efface the existing conditions of a long winter darkness by the hypothesis that the solar light was not, during the formation of the coal, distributed over the globe as it now is, but was far more diffusive, the solar body not having yet arrived at its present state of condensation.

That the polar area was the centre of origination for the successive phases of vegetation that have appeared in the globe is evidenced, under Count Saporta's view, by the fact that all formations, Carboniferous, Jurassic, Cretaceous, and Tertiary, are alike abundantly represented in the rocks of that area, and that, in each case, their constitutents closely resemble that of much lower latitudes. The first indications of the climate cooling in these regions is afforded by *Coniferæ*, which appear in the polar lower Cretaceous formations. These are followed by the first appearance of Dicotyledons with deciduous leaves, which again marks the period when the summer and winter season first became strongly contrasted. The introduction of these (deciduous-leaved trees) he regards as the greatest revolution in vegetation that the world has seen; and he conceives that once evolved they increased, both in multiplicity and in diversity of form,

with great rapidity, and not in one spot only, and continued to do so down to the present time.

Lastly, the advent of the Miocene period, in the polar area, was accompanied with the production of a profusion of genera, the majority of which have existing representatives which must now be sought in a latitude 40° farther south, and to which they were driven by the advent and advance of the glacial cold; and here Count Saporta's conclusions accord with those of Professor A. Gray, who first showed, now twenty years ago, that the representatives of the elements of the United States Flora previously inhabited high northern latitudes, from which they were driven south during the Glacial period.

Perhaps the most novel idea in Count Saporta's Essay is that of the diffused sunlight which (with a densely clouded atmosphere), the author assumes to have been operative in reducing the contrast between the polar summers and winters. If it be accepted it at once disposes of the difficulty of admitting that evergreen trees survived a long polar winter of total darkness, and a summer of constant stimulation by bright sunlight; and if, further, it is admitted that it is to internal heat we may ascribe the tropical aspect of the former vegetation of the polar region, then there is no necessity for assuming that the solar system at those periods was in a warmer area of stellar space, or that the position of the poles was altered, to account for the high temperature of Pre-Glacial times in high northern latitudes; or, lastly, that the main features of the great continents and oceans were very different in early geological times from what they now are. Count Saporta's views in certain points coincide with those of Professor Le Conte of California, who holds that the uniformity of climates during earlier conditions of the globe is not explicable by changes in the position of the poles, but is attributable to a higher temperature of the whole globe, whether due to external or internal causes, to the great amount of carbonic acid and water in the atmosphere, which would shut in and accumulate the sun's heat, according to the principles discovered by Tyndall and applied by Sterry Hunt in explanations of geological times. Le Conte, however, admits the possibility of the earth's having occupied a warmer position in stellar space, of its having exhibited a more uniform distribution of surface temperature, and a different distribution of land and water.*

Before Count Saporta's Essay had reached this country† another contribution to the subject of the origin of existing Floras had been communicated to our own Geographical Society, by Mr. Thiselton Dyer, in a Lecture on "Plant Distribution as a field for Geographical

* Professor Jos. Le Conte, in "Nature," October 24, 1878, p. 668.

† Count Saporta's Essay was presented to the International Congress of Geographical Science which met in Paris in 1875, and was not received by me till the autumn of 1878, though it bears the date 1877 on the title page.

Research." Mr. Thiselton Dyer's order of procedure is the reverse of Count Saporta's, and his method entirely different. He first gives a very clear outline of the distribution of the principal existing Floras of the continents and islands of the globe, their composition, and their relations to one another, and to those of previous geological epochs. He then discusses the views of botanists respecting their origin and distinctive characters, and availing himself of such of their hypotheses as he thinks tenable, correlates these with those of palæontologists, and arrives at the conclusion "That the northern hemisphere has always played the most important part in the evolution and distribution of new vegetable types, or in other words, that a greater number of plants has migrated from north to south than in the reverse direction, and that all the great assemblages of plants which we call Floras, seem to admit of being traced back at some time in their history to the northern hemisphere." This amount of accordance between the results of naturalists working wholly independently, from entirely different stand-points, and employing almost opposite methods, cannot but be considered as very satisfactory. I will conclude by observing that there is a certain analogy between two very salient points which are well brought out by these authors respectively. Count Saporta, looking to the past, makes it appear that the fact of the several Floras which have flourished on the globe being successively both more localised and more specialised, is the natural result of conditions to which it is assumed our globe has been successively subjected. Mr. Dyer, looking to the present, makes it appear that the several Floras now existing on the globe are, in point of affinity and specialisation, the natural results of the conditions to which they must have been subjected during recent geological time on continents and islands with the configuration of those of our globe.

The modern development of botanical science, being that which occupies my own attention, is naturally that on which I might feel especially inclined to dwell; and I should so far have the excuse that there is, perhaps, no branch of research with the early progress of which this Society is more intimately connected.

One of our earliest Secretaries, Robert Hooke, two centuries ago, laboured long and successfully in the improvement of the microscope as an implement of investigation. He was one of the first to reap the harvest of discovery in the new fields of knowledge to which it was the key, and if the results which he attained have rather the air of spoils gathered hither and thither in a treasury, the very fulness of which was embarrassing, we must remember that we date the starting point of modern histology from the account given by Hooke in his "Micrographia" (1667) of the structure of cork, which had attracted his interest from the singularity of its physical properties.

Hooke demonstrated its *cellular structure*, and by an interesting coincidence he was one of the first to investigate, at the request, indeed, of the founder of the Society, Charles II, the movements of the sensitive plant *Mimosa pudica*—one of a class of phenomena which is still occupying the attention of more than one of our Fellows. In attributing the loss of turgescence, which is the cause of the collapse of the petiole and subordinate portions of the compound leaf which it supports, to the escape of a subtle humour, he to some extent foreshadowed the modern view which attributes the collapse of the cells to the escape of water by some mechanism far from clearly understood—whether from the cell-cavities, or from the cell-walls into the intercellular spaces.

Hooke having shown the way, Nehemiah Grew, who was also Secretary of the Royal Society, and Marcello Malpighi, Professor of Medicine in the University of Bologna, were not slow to follow it. Almost simultaneously (1671–3) the researches of these two indefatigable students were presented to the Royal Society, and the publication of two editions of Malpighi's works in London proves how entirely this country was at that time regarded as the head quarters of this branch of scientific inquiry. We owe to them the generalisation of the cellular structure, which Hooke had ascertained in cork, for all other vegetable tissues. They described also accurately a host of microscopic structures then made known for the first time. Thus, to give one example, Grew figured and described in several different plants the stomata of the epidermis:—"Passports," as he writes, either "for the better avolation of superfluous sap, or the admission of air."

With the exception of Leeuwenhoek no observer attempted to make any substantial addition to the labours of Grew and Malpighi for more than a century and a half, and however remarkable is the impulse which he gave to morphological studies, the view of Caspar Wolff in the middle of the 18th century (1759), in regarding cells as the result of the action of an organizing power upon a matrix, and not as themselves influencing organization, were adverse to the progress of histology. It is from Schleiden (1838) who described the cell as the true unit of vegetable structure, and Schwann who extended this view to all organisms whether plants or animals, and gave its modern basis to biology by reasserting the unity of organization throughout animated nature, that we must date the modern achievements of histological science. Seldom, perhaps, in the history of science has any one man been allowed to see so magnificent a development of his ideas in the space of his own lifetime as has slowly grown up before the eyes of the venerable Schwann, and it was, therefore, with peculiar pleasure that a letter of congratulation was entrusted by your Officers to one of our Fellows on behalf of this Society on the recent occasion of the celebration of the 40th anniversary of Schwann's entry into the professorate.

If we call up in our mind's eye some vegetable organism and briefly reflect on its construction, we see that we may fix on three great steps in the analysis of its structure, the organic, the microscopic, and the molecular, and, although not in the same order, each of the three last centuries is identified with one of these. In the 17th century Grew achieved the microscopic analysis of plant tissues into their constituent cells; in the 18th, Caspar Wolff effected the organic analysis (independently but long subsequently expounded by the poet Goethe) of plant structures into stem and leaf. It remained for Nägeli in the present century to first lift the veil from the mysterious processes of plant growth, and by his memorable theory of the molecular constitution of the starch-grain and cell-wall, and their growth by intussusception (1858), to bring a large class of vital phenomena within the limits of physical interpretation. Strasburger has lately (1876) followed Sachs in extending Nägeli's views to the constitution of protoplasm itself, and there is now reason to believe that the ultimate structure of plants consists universally of solid molecules (not however identical with chemical molecules) surrounded with areas of water which may be extended or diminished. While the molecules of all the inert parts of plants (starch-grains, cell-wall, &c.) are on optical grounds believed by most physiologists to have a definite crystalline character, no such conclusion can be arrived at with respect to the molecules of protoplasm. In these molecules the characteristic properties of the protoplasm reside, and are more marked in the aggregate mass in proportion to its denseness, and this is due to the close approximation of the molecules and the tenuity of their watery envelopes. The more voluminous the envelopes, the more the properties of protoplasm merge in those of all other fluids.

It is, however, to the study of the nuclei of cells that attention has been recently paid with the most interesting results. These well-known structures, first observed by Ferdinand Bauer at the beginning of the century (1802), were only accurately described thirty years later by Robert Brown (1833). Up to the present time their function has been extremely obscure. The beautiful investigations of Strasburger (1875) have led him to the conclusion that the nucleus is the seat of a central force which has a kind of polarising influence upon the protoplasm molecules, causing them to arrange themselves in lines radiating outwards. Cell-division he regards as primarily caused by the nucleus becoming bipolar, and the so-called caryolitic figures first described by Auerbach, exhibit the same arrangement of the protoplasm molecules in connecting curves as in the case of iron-filings about the two poles of a bar-magnet. The two new centres mutually retire, and each influencing its own tract of protoplasm, the cell-division is thereby ultimately effected. This is but a brief account of processes which are greatly complicated in

actual detail, and of which it must be remarked that while the interest and beauty of the researches are beyond question, caution must be exercised in accepting the mechanical speculations by which Strasburger attempts to explain them. He has himself shown that cell-division presents the same phenomena in the animal kingdom; a result which has been confirmed by numerous observers, amongst whom I may content myself with mentioning one of our own Society, Mr. F. Balfour. Strasburger further points out that this affords an argument for the community of descent in animal and vegetable cells; he regards free cell-division as derivable from ordinary cell-division by the suppression of certain stages.

Turning now to the discoveries made during the last five years in Physiological Botany, we find that no one has advanced this subject so greatly as Mr. Darwin. In 1875 was published his work on Insectivorous Plants, in which he ascertained the fact that a number of species having elaborate structures adapted for the capture of insects, utilized the nitrogenous matter which these contain as food. The most important principle established in the course of these researches was, that such plants as *Drosera*, *Dionœa*, *Pinguicula*, secrete a digestive fluid, which has led through Gorup Bezanez's investigations on the ferment in germinating seeds, to a recognition of the active agency of ferments in the transmission of food-material, which marks a great advance in our knowledge of the general Physiology of Nutrition.

The extreme sensitiveness of the glands of *Drosera* to mechanical and chemical stimulus (especially to phosphate of ammonia), the directive power of its tentacles, depending upon the accurate transmission of motor impulses, and the "reflex" excitation of secretion in the glands, were all discoveries of the most suggestive nature in connexion with the subject of the irritability and movements of plants. The phenomenon of the aggregation of the protoplasmic cell-contents in the tentacles of *Drosera* is a discovery of a highly remarkable nature, though not yet thoroughly understood. Lastly, Mr. Frank Darwin, following his father's footsteps, as it were crowned the edifice by showing to what an extent insectivorous plants do profit by nitrogenous matter supplied to their leaves.

In close relation to these researches are those, also by Mr. Darwin, on the structure and functions of the bladder of *Utricularia*, which he has shown to have the power of absorbing decaying animal matter; and those of Mr. Frank Darwin on contractile filaments of extraordinary tenuity attached to the glands on the inner surface of the cups formed by the connate bases of the leaves of the Teasel, which filaments exhibit motions suggesting a protoplasmic origin. It is to be hoped that their discoverer will pursue his investigations into these curious bodies, whose origin and real nature in relation to the plant and its functions are involved in obscurity.

The subject of the cross-fertilization of plants, which though a long known phenomenon, first become a fruitful scientific study in Mr. Darwin's now classical work "On the various contrivances by which Orchids are fertilized," has within the last few years made rapid advance under its author's hand. The extreme importance of avoiding self-fertilization might indeed be inferred from the prevalence in flowers of elaborate contrivances for preventing it; but it remained to be shown that direct benefit attended cross-fertilization, and this has now been proved by an elaborate series of experiments, the results of which are not only that both increased fertility or greater vigour of constitution attend cross-fertilization, but that the opposite effects attend self-fertilization. In the course of these experiments it became evident that the good effects of the cross do not depend on the mere fact of the parents being different individuals, for when these were grown together and under the same conditions, no advantage was gained by the progeny; but when grown under different conditions a manifest advantage was gained. As instances, if plants of *Ipomœa* and *Mimulus*, which had been self-fertilized for seven previous generations, were kept together and then intercrossed, their offspring did not profit in the least; whereas, when the parent plants were grown under different conditions, a remarkably vigorous offspring was obtained.

Mr. Darwin's last work, "On the different forms of Flowers," though professedly a reprint of his paper on dimorphic plants, published by the Linnæan Society, contains many additions and new matter of great importance concerning the behaviour of polygamous plants, and on Cleistogamic flowers. Among other points of great interest is the establishment of very close analogies between the phenomena attending the illegitimate union of trimorphic plants, and the results of crosses between distinct species, the sterile offspring of the crosses of the same species exhibiting the closest resemblance to the sterile hybrids obtained by crossing distinct species; while a whole series of generalizations, founded on the results of the one series of experiments, are closely paralleled by those founded on the other. The bearing of this analogy on the origin of species is obviously important.

Besides these investigations, Mr. Darwin has produced within the last five years second editions of his volume on the Fertilization of Orchids, and on the Habits and Movements of Climbing Plants; as also of his early works on Coral Reefs, and Geological Observations in South America; all of them abounding in new matter.

Of special interest to myself, as having been conducted in the Jodrell Laboratory at Kew, are Dr. Burdon Sanderson's investigations on the exceptional property possessed by the leaves and other organs of some plants which exhibit definite movements in

response to mechanical, chemical, or electric stimuli. In 1873, Dr. Sanderson showed us in this meeting room, that the closing of the laminæ of the leaf of *Dionœa* is preceded by a preliminary state of excitement, and is attended with a change in the electric conditions of the leaf; and this so closely resembled the change which attends the excitation of the excitable tissues of animals, that he did not hesitate to identify the two phenomena.

This remarkable discovery immediately directed the attention of two German observers to the electromotive properties of plants, one, Dr. Kunkel, in the Laboratory of Professor Sachs; the other Professor Munk, in that of the University of Berlin.

Professor Munk, whose researches are of much the greater scope and importance, took as his point of departure Dr. Burdon Sanderson's discovery. The leading conclusion to which he arrived was, that in *Dionœa* each of the oblong cells of the parenchyma is endowed with electromotive properties, which correspond with those of the "muscle-cylinder" of animals; with this exception, that whereas in the muscle-cylinder the ends are negative to the central zone, in the vegetable cell they are positive; and he endeavours to prove, that according to this theory, all the complicated electromotive phenomena which had been observed, could be shown to be attributable to the peculiar arrangement of the leaf-cells.

During the last two summers Dr. Burdon Sanderson has been engaged in endeavouring to discover the true relations which subsist between the electrical disturbance, followed by the shutting of the leaf-valves of *Dionœa* and the latent change of protoplasm which precedes this operation. He has found that though the mechanism of the change of form of the excitable parenchyma which causes the contraction is entirely different from that of muscular contraction, yet that the correspondence between the exciting process in the animal tissues, and what represents this in plant tissues appears to be more complete the more carefully the comparison is made; and that whether the stimulus be mechanical, thermal, or electrical, its effects correspond in each case. Again, the excitation is propagated from the point of excitation to distant points in the order of their remoteness, and the degree to which the structure is excited depends upon its temperature. Notwithstanding, however, the striking analogies between the electrical properties of the cells of *Dionœa* and of muscle-cylinders, Dr. Burdon Sanderson is wholly unable to admit with Professor Munk that these structures are in this respect comparable.

In Morphological Botany attention has been especially directed of late to the complete life-history of the lower order of Cryptogams, since this is seen to be more and more an indispensable preliminary to any attempt at their correct classification.

The remarkable theory of Schwendener, now ten years old, astonished botanists by boldly sweeping away the claims to autonomous recognition of a whole group of highly characteristic organisms—the Lichens—and by affirming that these consist of ascomycetal fungi united in a commensal existence with Algæ. The controversial literature and renewed investigations which this theory has given rise to are now very considerable. But the advocates of the Schwendenerian view have gradually won their ground, and the success which has attended the experiments of Stahl in taking up the challenge of Schwendener's opponents and manufacturing such lichens as *Endocarpon* and *Thelidium*, by the juxtaposition of the appropriate Algæ and Fungi, may almost be regarded as deciding the question. Sachs, in the last edition of his Lehrbuch, has carried out completely the principle of classification of Algæ, first suggested by Cohn, and has proposed one for the remaining Thallophytes, which disregards their division into Fungi and Algæ. He looks upon the former as standing in the same relation to the latter as the so-called Saprophytes (*e.g. Neottia*) do to ordinary green flowering-plants.

This view has especial interest with regard to the minute organisms known as *Bacteria*, a knowledge of the life-history of which is of the greatest importance, having regard to the changes which they effect in all lifeless and, probably, in all living matter prone to decomposition. This affords a morphological argument (as far as it goes) against the doctrine of Spontaneous Generation, since it seems extremely probable that just as yeast may be a degraded form of some higher fungus, *Bacteria* may be degraded allies of the *Oscillatoriæ* which have adopted a purely saprophytal mode of existence.

Your "Proceedings" for the present year contain several important contributions to our knowledge of the lowest forms of life. The Rev. W. H. Dallinger, continuing those researches which his skill in using the highest microscopic powers and his ingenuity in devising experimental methods have rendered so fruitful, has adduced evidence which seems to leave no doubt that the spores or germs of the monad which he has described differ in a remarkable manner from the young or adult monads in their power of resisting heated fluids. The young and adult monads, in fact, were always killed by five minutes' exposure to a temperature of 142° F. (61° C.), while the spores germinated after being subjected to a temperature of ten degrees above the boiling point of water (222° F.).

Two years ago, Cohn and Koch observed the development of spores within the rods of *Bacillus subtilis* and *B. anthracis*. These observations have been confirmed, with important additions, in these two species by Mr. Ewart, and have been extended to the *Bacillus* of the infectious pneumo-enteritis of the pig, by Dr. Klein; and to *Spirillum* by Messrs. Geddes and Ewart; and thus a very important step has

been made towards the completion of our knowledge of the life-history of these minute but important organisms. Dr. Klein has shown that the infectious pneumo-enteritis, or typhoid fever of the pig, is, like splenic fever, due to a *Bacillus*. Having succeeded in cultivating this *Bacillus* in such a manner as to raise crops free from all other organisms, Dr. Klein inoculated healthy pigs with the fluid containing the *Bacilli*, and found that the disease in due time arose and followed its ordinary course. It is now therefore, distinctly proved that two diseases of the higher animals, namely, "splenic fever" and "infectious pneumo-enteritis," are generated by a *contagium vivum*.

Finally, Messrs. Downes and Blunt have commenced an enquiry into the influence of light upon *Bacteria* and other *Fungi*, which promises to yield results of great interest, the general tendency of these investigations leaning towards the conclusion that exposure to strong solar light checks and even arrests the development of such organisms.

The practical utility of investigations relating to *Bacillus* organisms as affording to the pathologist a valuable means of associating by community of origin various diseases of apparently different character, is exemplified in the "Loodiana fever," which has been so fatal to horses in the East. The dried blood of horses that had died of this disease in India has been recently sent to the Brown Institution, and from seeds therein contained a crop of *Bacillus anthracis* has been grown, which justified its distant pathological origin by reproducing the disease in other animals. Other equally interesting experiments have been made at the same Institution, showing that the "grains" which are so largely used as food for cattle, afford a soil which is peculiarly favourable for the development and growth of the spore filaments of *Bacillus;* and that by such "grains" when inspected, the anthrax fever can be produced at will, under conditions so simple that they must often arise accidentally. The bearing of this fact on a recent instance in which anthrax suddenly broke out in a previously uninfected district, destroying a large number of animals, all of which had been fed with grains obtained from a particular brewery, need scarcely be indicated.

In Systematic Botany, which in a nation like ours, ever extending its dominions and exploring unknown regions of the globe, must always absorb a large share of the energies of its phytologists, I can but allude to two works of great magnitude and importance.

Of these, the first is the "Flora Australiensis" of Bentham, completed only a year ago; a work which has well been called unique in botanical literature, whether for the vast area whose vegetation it embraces (the largest hitherto successfully dealt with), or for the masterly manner in which the details of the structure and affinities of upwards of 8,000 species have been elaborated. Its value in reference

to all future researches regarding the geographical distribution of plants in the southern hemisphere, and the evolution therein of generic and specific types, cannot be over estimated.

The other great work is the "Flora Braziliensis," commenced by our late Foreign Fellow, von Martius, and now ably carried on by Eichler, of Berlin, assisted by coadjutors (among whom are most of our leading systematists) under the liberal auspices of His Majesty the Emperor of Brazil. When completed, this gigantic undertaking will have embraced, in a systematic form, the vegetation of the richest botanical region of the globe.

Having now endeavoured to recall to you some of the great advances in Science made during the last few years, it remains for me, after the distribution of the Medals awarded by your Council, to retire from the Presidency in which I have so long experienced the generous support of your Officers and yourselves. This support, for which I tender you my hearty thanks, together with my sense of the trust and dignity of the office, and the interest attached to its duties, make my resignation of it a more difficult step than I had anticipated. My reasons are, however, strong. They are the pressure of official duties at Kew, annually increasing in amount and responsibility, together with the engagements I am under to complete scientific works, undertaken jointly with other botanists, before you raised me to the Presidency; and the fact that indefinite postponement delays the publication of the labours of my coadjutors. I am also influenced by the consideration that, though wholly opposed to the view that the term of the Presidency of the Royal Society should be either short or definitely limited, this term should not be very long; and that, considering the special nature of my own scientific studies, it should, in my case, on this as well as on other grounds, be briefer than might otherwise be desirable. Cogent as these reasons are, they might not have been paramount, were it not that we have among us, one pre-eminently fitted to be your President by scientific attainments, by personal qualifications, and by intimate knowledge of the Society's affairs; and by calling upon whom to fill the proud position which I have occupied, you are also recognising the great services he has rendered to the Society as its Treasurer for eight years, and its ofttimes munificent benefactor.

On the motion of Dr. Graham Balfour, seconded by Sir Alexander Armstrong, 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 Jean Baptiste Boussingault

for his long-continued and important researches and discoveries in agricultural chemistry.

The researches of Boussingault have extended over nearly half a century, and it might be difficult to find an investigator whose results relating to a great variety of subjects have in respect of accuracy and trustworthiness better stood the test of time.

The lucid simplicity with which his writings narrate well-established and well-arranged facts, is not less remarkable than the judicial caution with which he has abstained from expressing opinions upon questions beyond the reach of decisive evidence.

His experimental results and the conclusions which he has drawn from them have been deservedly trusted by other workers in the same field, and have safely guided them in their labours. Their incontestable excellence has prevented them from becoming subjects of animated discussion, and thus arousing as much attention and interest in the outer world as has sometimes been aroused by hasty experiments and daring generalizations.

I cannot attempt within the limits of this address to give an account of his investigations, and I should probably weary you were I even to enumerate them, relating as they do to a vast variety of phenomena; but I may point out that lying as most of them do in the domain of agricultural chemistry, they have involved difficulties of no common order. Boussingault is not only an excellent chemical analyst and experimentalist, but at the same time a model farmer.

His numerous determinations of the nitrogen, carbon, and hydrogen in crops and in the manures supplied to them, have proved him to be skilled not only in selecting and applying the best known methods of analysis, but even in improving and perfecting them.

His determinations of the proportions of those valuable constituents of manures which can be assimilated by various crops, have involved an intimate acquaintance with the conditions which experience has proved to be most favourable to the cultivation of the various crops.

His numerous and varied experiments on the feeding of animals, showing the proportions between the nitrogenized and fatty or amylaceous constituents supplied in the food and those assimilated or formed by the animal organism, while tracing the distribution of the remainder between the pulmonary and other excretions, have had most important physiological as well as practical bearings.

In all his investigations we see proofs that while accurately and critically acquainted with the discoveries and opinions of other workers and thinkers in his own particular domain of science, he has been able to devise and carry out simple and crucial forms of experiment well calculated to decide the truth.

A remarkable instance of this is afforded by those truly masterly experiments by which he proved that all the nitrogen found in the

organism of plants can be traced to compounds of that element which had been supplied to them; and accordingly that there are no grounds for believing that plants can assimilate the free nitrogen of the air.

By awarding to Boussingault the Copley Medal, we place his name in the honoured list of those who, in modern times, have rendered the highest services to the advancement of natural knowledge.

A Royal Medal has been awarded to Mr. John Allan Broun for his investigations during thirty-five years in magnetism and meteorology, and for his improved methods of observation.

When the labours of Gauss had given an impetus to the study of terrestrial magnetism by rendering precision possible, Observatories devoted to this branch of research, in conjunction with meteorology, began to rise in various places. The late General Sir T. M. Brisbane erected one at Makerstown, in Scotland, and placed it under the direction of Mr. Broun, who remained in charge of it from 1842 to 1850. His observations and their results, have been commended by magneticians and meteorologists, for the skill employed in the development of new methods of reduction and investigation.

In 1851 Mr. Broun went to India to organize and take charge of a similar Observatory established at Trevandrum by His Highness the late Rajah of Travancore. Here he remained for thirteen years, accumulating results of very great value, the first instalment of which, consisting of a volume on the magnetic declination, was published some years ago. Magneticians look eagerly towards the completion of this publication when the means necessary for the purpose shall have been furnished to Mr. Broun.

While in India he established an Observatory on a mountain peak 6,000 feet above the sea, and fitted it up with a very complete assortment of scientific instruments. This was an undertaking of a very arduous nature, effected in a wild country, and presenting great difficulties in the erection of instruments and obtaining trained observers.

Shortly after the commencement of magnetic observatories, Mr. Broun indicated the insufficiencies of the methods then in use for determining coefficients and correcting observations, and he devised new methods for these ends, the principal of which have been generally adopted.

This is not the place in which to give a complete catalogue of Mr. Broun's researches in magnetism and meteorology, extending as they do over a period of thirty-five years, but I may indicate those of his results that are of the greatest importance. Among them are the establishment of the annual laws of magnetic horizontal force, exhibiting maxima at the solstices and minima at the equinoxes. Mr. Broun was also the first to give in a complete form the laws of change of the solar-diurnal variation of magnetic declination near the

equator, showing the extinction of the mean movement near the equinox. His researches on the lunar-diurnal variation of magnetic declination are of very great interest. Besides being an independent discoverer of the existence of this variation, he showed that near the equator its law in December was the opposite of that in June. He found, too, that the lunar-diurnal variation was in December sometimes greater than the solar-diurnal variation—that the lunar action was reversed at sunrise, and that it was much greater during the day than during the night, whether the moon was above or below the horizon. Finally, he found that the lunar-diurnal law changed (like the solar-diurnal law at the equator) near the equinoxes, so that, as a consequence, the laws for the southern and northern hemispheres were of opposite natures.

Another and very remarkable fact discovered by Mr. Broun was that the variations from day to day of the earth's daily mean horizontal force were nearly the same all the world over. He found certain oscillations in these daily means which were due to the moon's revolution, and others having a period of twenty-six days; the latter he considered as due to the sun's rotation. It results from these investigations that the observed variations of the earth's daily mean horizontal force have been represented with considerable accuracy in all their more marked features, by the combination of the means calculated for these different solar and lunar periods. During the discussion of these periods, Mr. Broun found that the great magnetic disturbances were apparently due to actions proceeding from particular points or meridians of the sun—a fact this (if verified) of very great importance.

In meteorology he has shown the apparent simultaneity of the changes of daily mean barometric pressure over a great part of the globe, and he has likewise discovered a barometric period of twenty-six days nearly. He was also the first to commence and carry out, during several years, a systematic series of observations of the motions of clouds at different heights in the atmosphere; and, lastly, he has found certain laws connecting the motions of the atmosphere, and the directions of the lines of equal barometric pressure.

A Royal Medal has been awarded to Dr. Albert Günther, F.R.S., for his numerous and valuable contributions to the zoology and anatomy of fishes and reptiles.

Dr. Günther's labours as a systematist and a descriptive zoologist have been devoted chiefly to the order of Fishes, Reptiles, and Amphibia. Upon these he has published during the last quarter of a century a very long series of valuable papers, whereby our knowledge of the structure, affinities, and distribution of the genera and species of those interesting groups has been greatly advanced. We owe to his indefatigable exertions the excellent condition in point of arrangement

and nomenclature of the unrivalled collection of fishes in the British Museum, and of which he prepared a systematic catalogue in eight volumes, which has been published by order of the Trustees. This is a work of prodigious labour; it required for its satisfactory execution an intimate knowledge of the fish of all parts of the world, and an intuitive perception of the natural character upon which a sound classification should be based. From possessing these attributes it has been accepted as the standard authority on the order by all zoologists. Under this head too I must specially allude to his excellent work on the Ceratodus. The Reptilian collections of the Museum have been no less successfully dealt with by Dr. Günther, and have afforded the material for some of his most important works, amongst which his "Reptiles of British India," "Memoir on Hatteria," and "Monograph of the Gigantic Land Tortoises of certain islands in the Pacific and Indian Oceans," are examples conspicuous for their completeness and accuracy.

The Rumford Medal has been awarded to Mr. Alfred Cornu for his various Optical Researches, and especially for his recent redetermination of the Velocity of Propagation of Light.

Mr. Alfred Cornu is the author of papers on optical and other subjects published in the "Comptes Rendus" and other scientific periodicals. He has been engaged, for example, with the difficult subject of crystalline reflection, and kindred researches.

It was in 1849 that Fizeau astonished the scientific world by an actual experimental determination of the velocity of light, a velocity so enormous that hitherto its finiteness has been proved, and its value approximately determined, only by two astronomical phenomena. Foucault almost simultaneously brought out an experimental determination by a totally different method.

The method of Fizeau gave at once a near approximation to the value got from those two astronomical phenomena, combined with the parallax of the sun, assumed known. But the difficulties of obtaining a sufficiently accurate result were such that the velocity obtained by Fizeau's method was not considered to rival in exactness the velocity determined astronomically. Indeed, Foucault's method seemed to be preferred, though Fizeau's is the simpler in principle, and is free from certain doubts which may be raised as regards the other. But the difficulties alluded to, which turned mainly on the determination of the velocity of the revolving wheel, were such that almost twenty years have elapsed without the method having been brought to a sufficient degree of perfection to make it astronomically available.

Such was the state of the problem when it was taken up by M. Cornu. By methods of his own devising he succeeded in getting over the difficulties with which Fizeau's further progress had been

stopped, and in achieving a determination so exact as to compete with the astronomical determinations, and thereby lead, we may say, to an experimental determination of the solar parallax fully rivalling that which is likely to result from the observations of the transit of Venus which have been carried out at so much cost and trouble.

A double award of the recently instituted Davy Medal has again been made, the recipients on the present occasion being M. Louis Paul Cailletet and M. Raoul Pictet. This award is made to these distinguished men for having, independently and contemporaneously, liquefied the whole of the gases hitherto called permanent.

The methods pursued by these experimenters, in accomplishing results which equal in interest and importance those obtained by Faraday in the same direction fifty-five years ago, were quite distinct, and were, in each case, the result of several years' preparatory labour. M. Cailletet, by comparatively very simple arrangements, such as admit of ready employment in lecture-demonstrations, has succeeded in obtaining evidence of the liquefaction, and possibly solidification, of carbonic oxide, marsh-gas, oxygen, nitrogen, and hydrogen. His system of operating consists in submitting the gases to very powerful compression at comparatively moderate degrees of cold, and in then allowing them very suddenly to expand.

M. Pictet has applied the very perfect system, elaborated and put to industrial use by him, for obtaining low temperatures to the attainment, though on a larger scale, of results like some of those arrived at by M. Cailletet. By an arrangement of vacuum and force pumps he reduces liquefied sulphurous acid to a low temperature, and applies this as the means for cooling down liquid carbonic acid which, in turn, serves to reduce to a very low temperature a thick glass tube, in which the gas to be condensed is confined at a very high pressure. M. Pictet has not only produced liquid oxygen in somewhat considerable quantity, and succeeded in determining its density, he has also obtained evidence of the solidification of hydrogen, and the description given of its appearance in the solid form seems to leave no doubt regarding its metallic character.

The interest which attaches to the remarkable experiments of MM. Cailletet and Pictet is only equalled by the importance of the fact, now absolutely demonstrated by those experiments, that the property of molecular cohesion is common to all known bodies without exception.

The Statutes relating to the election of Council and Officers were then read, and Mr. Ellis and Mr. McLachlan 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, F.G.S., F.S.A.

Secretaries.— { Professor George Gabriel Stokes, M.A., D.C.L., LL.D.
Professor Thomas Henry Huxley, LL.D.

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

Other Members of the Council.—Frederick A. Abel, C.B., V.P.C.S.; William Bowman, F.R.C.S.; William Carruthers, V.P.L.S.; Major-General Henry Clerk, R.A.; William Crookes, V.P.C.S.; Sir William Robert Grove, M.A.; Augustus G. Vernon Harcourt, F.C.S.; Sir Joseph Dalton Hooker, C.B., K.C.S.I., D.C.L.; Admiral Sir Astley Cooper Key, K.C.B.; Lieut.-General Sir Henry Lefroy, C.B.; Lord Lindsay, P.R.A.S.; Sir John Lubbock, Bart., V.P.L.S.; Lord Rayleigh, M.A.; Charles William Siemens, D.C.L.; John Simon, C.B., D.C.L.; Professor Allen Thomson, M.D., F.R.S.E.

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.	Com-pounders.	£4 yearly.	Total.
November 30, 1877.	4	43	252	253	552
Elected		+ 7	+ 4	+ 13	+ 24
Deceased		− 6	− 5	− 16	− 27
Since compounded			+ 2	− 2	
November 30, 1878.	4	44	253	248	549

Statement of Receipts and Expenditure from November 23, 1877, to November 28, 1878.

Receipts	£	s.	d.
Annual Contributions	1,032	0	0
Admission Fees	170	0	0
Compositions	312	0	0
Sale £15,727 10*s.* 6*d.* Consols	15,000	0	0
Rents	321	4	8
Dividends (exclusive of Trust Funds)	1,345	17	11
,, on Jodrell Fund	183	10	9
Interest on Mortgage Loan	294	9	8
Sale of Transactions, Proceedings, &c.	716	16	6
Sundries	2	6	0
Donations for cost of Plates	100	0	0
,, for Donation Fund	5	5	0
Balances from 1877	933	11	1
	£20,417	1	7

Expenditure	£	s.	d.	£	s.	d.
Mortgage Loan				15,000	0	0
Bought £662 16*s.* Consols				628	0	0
Salaries and Wages				1,120	4	0
Illustrations and Paper for Report of Naturalists (Transit-of-Venus Expedition)				199	10	5
The Scientific Catalogue				210	12	0
Books for the Library				142	11	11
Binding ditto				100	17	4
Printing Transactions, Part II. 1877, and Part I. 1878, and Separate Copies to Authors and Publisher	388	19	10			
Ditto Proceedings, Nos. 170–182	395	8	10			
Ditto Miscellaneous	67	4	1	1,903	6	10
Paper for Transactions and Proceedings	418	15	0			
Binding and Stitching ditto	114	16	11			
Engraving and Lithography	518	2	2			
Soirée and Reception Expenses				90	12	3
Coal, Lighting, &c.	90	14	5			
Office Expenses	29	4	9			
House Expenses	91	1	7			
Tea Expenses	20	8	6			
Fire Insurance	41	15	0	351	6	9
Taxes	22	13	9			
Advertising	16	19	0			
Postage, Parcels, and Petty Charges	36	7	9			
Mablethorpe Schools, Donation	2	2	0			
				£19,747	1	6

Trust Funds.

	£	s.	d.	£	s.	d.
Donation Fund Dividends	186	18	5			
Handley Fund "	173	19	11			
Rumford Fund "	68	10	7	507	4	2
Wintringham Fund "	35	8	0			
Copley Medal Fund "	9	18	4			
Davy Medal Fund "	32	8	11			
				£20,924	5	9

	£	s.	d.	£	s.	d.
Donation Fund	105	5	0			
Davy Medal Fund	108	5	1			
Wintringham Fund	35	11	0	260	19	8
Copley Medal Fund	4	15	1			
Bakerian Lecture	4	4	3			
Croonian Lecture	2	19	3			
Balance at Bank				894	2	3
Balances on hand, Catalogue and Petty Cash				22	2	4
				£20,924	5	9

W. SPOTTISWOODE,

Treasurer.

Estates and Property of the Royal Society, including Trust Funds.

Estate at Mablethorpe, Lincolnshire (55 A. 2 R. 2 P.), £136 per annum.

Estate at Acton, Middlesex (34 A. 2 R. $4\frac{3}{4}$ P.), £167 17*s.* 10*d.* 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 £485 3*s.* 4*d.* in 1877-78).

£19,898 2*s.* 5*d.* Reduced 3 per Cent. Annuities.

£15,000 Mortgage Loan, 4 per Cent.

£16,588 6*s.* 2*d.* Consolidated Bank Annuities.

£403 9*s.* 8*d.* New $2\frac{1}{2}$ per Cent. Stock—Bakerian and Copley Medal Fund.

£6,221 14*s.* 1*d.* New Threes.—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.

Trust Funds. 1878.

Scientific Relief Fund.

	£	s.	d.
New 3 per Cent. Annuities	6,328	11	2
Metropolitan $3\frac{1}{2}$ Consols	100	0	0
	£6,428	11	2

Dr.	£	s.	d.	*Cr.*	£	s.	d.
Balance	229	12	9	By Grants	250	0	0
Dividends	190	3	10	Expenses	0	5	0
				Balance	169	11	7
	£419	16	7		£419	16	7

Donation Fund.

£6,339 0*s.* 1*d.* Consols.

Dr.	£	s.	d.	*Cr.*	£	s.	d.
To Balance	246	2	7	By Grants	300	0	0
Dividends	186	18	5	Bought £5 9*s.* 9*d.* Consols	5	5	0
Donation	5	5	0	Balance	133	1	0
	£438	6	0		£438	6	0

Rumford Fund.

£2,322 19*s*. Consols.

	£	*s.*	*d.*		£	*s.*	*d.*
Balance, 1877	68	16	6	Balance	137	7	1
Dividend, 1878	68	10	7				
	£137	7	1				

Bakerian and Copley Medal Fund.

£403 9*s*. 8*d*. New 2½ per Cent.

	£	*s.*	*d.*		£	*s.*	*d.*
To Balance	73	0	1	By Gold Medal	4	15	1
Dividends	9	18	4	Bakerian Lecture and Expenses	4	4	3
				Balance	73	19	1
	£82	18	5		£82	18	5

Wintringham Fund.

£1,200 Consols.

	£	*s.*	*d.*		£	*s.*	*d.*
To Balance, 1877	35	11	0	By Payment to Foundling Hospital, 1878	35	11	0
Dividends, 1878	35	8	0	Balance	35	8	0
	£70	19	0		£70	19	0

Croonian Lecture Fund.

	£	*s.*	*d.*		£	*s.*	*d.*
To one-fifth of Rent of Estate at Lambeth Hill, payable by the College of Physicians	2	19	3	By Croonian Lecture	2	19	3

Davy Medal Fund.

£660 Madras Guaranteed 5 per Cent. Railway Stock.

	£	s.	d.		£	s.	d.
To Balance	246	3	5	By Dies and Fittings	48	4	1
Dividends	32	8	11	,, Gold Medals	60	1	0
				Balance	170	7	3
	£278	12	4		£278	12	4

The Gassiot Trust.

£10,000 Italian Irrigation Bonds.

	£	s.	d.		£	s.	d.
To Balance	236	0	0	By Payments to Kew Committee	495	15	3
Dividends	495	15	3	Bonds bought	179	10	0
Bonds drawn	234	10	0	Balance	291	0	0
	£966	5	3		£966	5	3

The Jodrell Fund.

£6,221 14*s.* 1*d.* New 3 per Cent. Stock.

	£	s.	d.		£	s.	d.
Dividends, 1878	183	10	9	By Payment to Royal Society	183	10	9

The Handley Fund.

£5,898 2*s.* 5*d.* Reduced 3 per Cent. Stock.

	£	s.	d.		£ s. d.	£	s.	d.
Balance, 1877	405	18	11	By Payment to Royal Society, 1877	264 17 9	438	17	8
Dividends, 1878	173	19	11	,, ,, ,, 1878	173 19 11			
				Balance of Capital Account		141	1	2
	£579	18	10			£579	18	10

Account of Grants from the Donation Fund in 1877–78.

	£	s.	d.
For Illustrations for the Naturalists' (Transit of Venus) Reports	£200	0	0
J. Evans, for Exploration of Caves in Borneo	50	0	0
J. E. H. Gordon, for continuation of Researches on the Specific Inductive Capacity of Dielectrics	25	0	0
W. R. Hodgkinson, for an Investigation on the Action of Ethylbenzol Acetate upon acetic, butyric, and isobutyric Ethers	25	0	0
	£300	0	0

Account of the appropriation of the sum of £1,000 (the Government Grant) annually voted by Parliament to the Royal Society, to be employed in aiding the advancement of Science (continued from Vol. XXVI, p. 457).

1878.

1. W. Ramsay, for Apparatus to be employed in a Research into the Action of Light and Heat in Decomposing Hydriodic and Hydrobromic Acids, with a view to compare the action of Heat and Light	£30
2. J. H. Poynting, to determine the Mean Density of the Earth by means of an Ordinary Balance in place of the Torsion Balance, and to Investigate means to very greatly increase the Accuracy of the Balance	150
3. Captain Abney, for registering the Intensity of the Spectrum of Daylight	50
4. Dr. Duncan and P. Sladen, for Publication of a Monograph of the Arctic Echinodermata, especially those of Smith's Sound and to the North	60
5. Bevan Lewis, for a Research into the Histology of the Cerebral Cortex in Man and the higher Mammalia, with especial reference to the Motor Area as defined by Professor Ferrier	15
6. D. Mackintosh, for aid in tracking Streams of Erratic Blocks from their Parent Rocks, to ascertain the Character of the Drift Deposits with which they are associated	25
7. W. C. Williamson, for continuation of Researches into the Fossil Plants of the Coal Measures	30
Carried forward	£360

Brought forward.............. £360

8. Professor Lankester, for the Investigation of the Life-History and Specific Forms of Bacteria; the Relation of Special Forms to Special Putrefactive and other Physiological Activities; and the Generic and Specific Distinctions.................... 40

9. A. Wynter Blyth, for continuation of Researches into the Chemical Constitution of the Poison of the Cobra de Capello .. 20

10. M. M. Pattison Muir, for Investigation of the Chemical Nature of Essential Oil of Sage, and the Determination of the Chemical and Physical Constituents of this Oil 30

11. A. Macfarlane, for Apparatus to continue and extend an exact experimental Research into the Conditions of Passage of the Disruptive Discharge of Electricity 50

12. W. Crookes, for continuing his Researches connected with Repulsion resulting from Radiation 200

13. Professor Church, for continuation of Researches in Plant Chemistry 50

14. E. Neison, for Computations in the Lunar Theory 75

15. G. J. Stoney, for completing a Spectroscope of great Aperture and continuing his Experiments on the Motions in Gases 100

16. B. Stewart, for analysing the Records of Magnetic Declination 75

17. Baron Ettingshausen, for travelling expenses, and maintenance in England during the preparation of a Monograph on the Eocene Flora of Great Britain........................... 50

£1050

Dr.	£	s.	d.	*Cr.*	£	s.	d.
To Balance on hand, Nov. 30, 1877	1015	13	6	By Appropriations, as above	1050	0	0
Grant from Treasury, 1878	1000	0	0	Printing, Postage, and Advertising	8	5	7
Repayments.				Balance on hand, Nov. 30, 1878	1032	5	8
R. H. Scott, balance £35 0 0							
W. Ramsay ,, 30 0 0							
	65	0	0				
Interest..........................	9	17	9				
	2090	11	3		2090	11	3

Account of appropriations from the Government Fund of £4,000 made by the Lords of the Committee of Council on Education, on the recommendation of the Council of the Royal Society.

1878.

D. Gill, to defray expenses connected with a Determination of the Solar Parallax by Observation of the Diurnal Parallax of Mars	£250
Rev. Dr. Haughton, for aid in the Numerical Reductions of the Tidal Observations made on board the "Discovery" and "Alert" in the late Arctic Expedition	75
J. A. Broun, for continuation of Correction of the Errors in the Published Observations of the Colonial Magnetic Observatories	150
J. P. Joule, for an Exhaustive Enquiry into the Change which takes place in the Freezing and Boiling Points of Mercurial Thermometers by Long Exposure to those Temperatures	200
Professor Jenkin, for Experimental Investigations on Friction	50
W. C. Roberts, for Researches on Metals and Alloys in a Molten State passing through Capillary Tubes	25
J. Kerr, for continuation of Electro-optic and Magneto-optic Researches	50
J. N. Lockyer, for continuation of Spectroscopic Researches	200
Dr. O. J. Lodge, for Investigations into the Effect of Light on the Residual Charge of Dielectrics; on the Conductivity of Hot Glass, and other Transparent Conductors; on Electrolytic Conduction and other subjects	100
Mr. Stevenson, for aid in carrying on Observations of the Temperature of Salmon Rivers in Scotland, and other Meteorological Observations	50
W. Galloway, for further Investigation of the Explosive Properties of Mixtures of Firedamp and Coal Dust with Air	100
Sir W. Thomson, for continuation of Tidal Investigation	100
Sir W. Thomson, for experiments in Magnetisation of Different Qualities of Iron, Nickel, and Cobalt under varying Stresses and Temperatures	100
J. E. H. Gordon, for continuation of Experimental Measurements of the Specific Inductive Capacity of Dielectrics	100
H. Tomlinson, for Researches on the Alteration of Thermal and Electrical Conductivity produced by Magnetism; and on the	
Carried forward	£1550

Brought forward.............	£1550
Alteration of Electrical Resistance produced in Wires by Stretching	100
H. Alleyne Nicholson and R. Etheridge, jun., for aid in examining the Fauna of the Silurian Deposits of the Girvan District, Ayrshire, and in publishing a Descriptive List of the same	75
W. K. Parker, for assistance in continuation of Researches on the Morphology of the Vertebrate Skeleton, and the Relations of the Nervous to the Skeletal Structure, chiefly in the Head ..	300
R. McLachlan, for aid towards the expense of publication of a Revision and Synopsis of European Trichoptera	50
C. Callaway, for aid in working out the so-called Eruptive Rocks of Shropshire, and in verifying certain points in Local Geology	25
H. T. Stainton, in aid of the Publication Fund of the Zoological Record Association	150
J. W. Dawson, for aid in excavating erect Trees in the Coal Formation of Nova Scotia, in Beds where they are known to contain Reptilian and other Remains.......................	50
Professor A. H. Garrod, for aid towards production of the Second Fasciculus of an exhaustive Treatise on the Anatomy of Birds	100
Rev. J. F. Blake, for aid in continuing the publication of a Synopsis of British Fossil Cephalopoda	100
Dr. W. A. Brailey, for Researches on the Causes determining the Tension of the Globe of the Eye in Man and Animals, and on the Physiological Influence on this Tension of such substances as Atropia, Daturin, Eserin, and Pilocarpine	50
W. Saville Kent, to pay for Microscopical Apparatus for the further Prosecution of Investigations into the Structure and Life-History of certain Lower Protozoa	50
Dr. R. H. Traquair, for aid in preparing and publishing a Monograph on the Carboniferous Ganoid Fishes of Great Britain	75
E. A. Schäfer, for payment of an Assistant in continuing his Histological and Embryological Investigations	50
H. Woodward, for continuation of work on the Fossil Crustacea, especially with reference to the Trilobita and other Extinct Forms, and their publication in the Volumes of the Palæontographical Society	75
Professor Seeley, for an Examination of the Structure, Affinities, and Classification of the extinct Reptilia and allied Animals...	75
Dr. Wright, for continuation of Researches on certain points	
Carried forward..............	£2875

Brought forward.............	£2875
in Chemical Dynamics; on the determination of Chemical Affinity in terms of Electrical Magnitudes; and on some of the less known Alkaloids	300
C. Schorlemmer, for continuation of Researches into (1) the Normal Paraffins (2) Suberone (3) Aurin	250
E. J. Mills, for a Research on Standard Industrial Curves ..	100
W. N. Hartley, for Investigation of the Fluid Contents of Mineral Cavities; of the Properties of the Phosphate of Cerium; of Methods of Estimating the Carbonic Acid in small samples of Air; and of Photographic Spectra..........................	150
Dr. Armstrong, for continuation of Researches into the Phenol Series	250
	3925
Administrative Expenses............................	75
	£4000