November 30, 1865.

ANNIVERSARY MEETING.

Lieut.-General SABINE, President, in the Chair.

Mr. Bowman, on the part of the Auditors of the Treasurer's Accounts appointed by the Society, reported that the total receipts during the last year, including a balance of £683 14*s.* 1*d.* carried from the preceding year, amounted to £4882 0*s.* 1*d.*; and that the total expenditure in the same period, including £905 invested in the Funds, amounted to £5001 18*s.* 11*d.*, leaving a balance of £135 7*s.* 10*d.* due to the Bankers, and £15 9*s.* i 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.

Royal.

His Imperial and Royal Highness the Archduke Maximilian of Austria.

On the Home List.

John George Appold, Esq.
George Boole, Esq.
George William Frederick Howard, Earl of Carlisle, K.G.
Samuel Hunter Christie, M.A.
Joseph Dickinson, M.D.
Hugh Falconer, M.A., M.D.
Rear-Admiral Robert FitzRoy.
Benjamin Gompertz, Esq.
Richard Dugard Grainger, Esq.
Woronzow Greig, Esq.
Sir Benjamin Heywood, Bart.
Sir William Jackson Hooker, K.H., LL.D.
Rev. George Hunt, M.A.
William Thomas Horner Fox Strangways, Earl of Ilchester, M.A.
John Lindley, Esq., Ph.D.
Sir John W. Lubbock, Bart., M.A.
James Heywood Markland, D.C.L.
Sir John Maxwell, Bart.
James B. Neilson, Esq.
Algernon Percy, Duke of Northumberland, K.G.
Benjamin Oliveira, Esq.
Henry John Temple, Viscount Palmerston, K.G.
Thomas Joseph Pettigrew, Esq.
Sir John Richardson, C.B.
Sir Robert Schomburgk.
Robert William Sievier, Esq.
Admiral William Henry Smyth, K.S.F.
Henry Herbert Southey, M.D.
Rev. Robert Walker, M.A.
Thomas Williams, M.D.

On the Foreign List.

Johann Franz Encke. | Adolph Theodor Kupffer.

Withdrawn.

William Hopkins, M.A., LL.D.

Defaulter.

William Bird Herapath, M.D.

Fellows elected since the last Anniversary.

On the Home List.

Dufferin and Claneboye, Frederick Temple Blackwood, Lord, K.P., K.C.B.
Donoughmore, Richard John Hely Hutchinson, Earl of.
Turner, The Right Hon. Sir George James, Lord Justice.
H.R.H. Louis Philippe d'Orléans, Count of Paris.
The Hon. James Cockle, M.A.
Rev. William Rutter Dawes.
Archibald Geikie, Esq.
George Gore, Esq.
Robert Grant, Esq., M.A.
George Robert Gray, Esq.
George Harley, M.D.
Fleeming Jenkin, Esq.
William Huggins, Esq.
Sir F. Leopold M'Clintock, Commodore.
Robert M'Donnell, M.D.
William Kitchen Parker, Esq.
Alfred Tennyson, Esq., D.C.L.
George Henry Kendrick Thwaites, Esq.
Lieut.-Col. James Thomas Walker, R.E.
The Right Hon. Charles Pelham Villiers.

The PRESIDENT then addressed the Society as follows:—

GENTLEMEN,

IN my last year's Address I informed you of the steps which had been taken, with the approval of the Council, to obtain the concurrence of Her Majesty's Government in the printing and publication of the Catalogue of the Titles of the Scientific Memoirs contained in Scientific Periodicals in all languages, from the commencement of the present century to the end of 1863, the manuscript of which had been prepared under the direction and superintendence of the President and Council, and the cost defrayed from the funds of the Society. Her Majesty's Government having been pleased to accede to the proposition that had been then made to them, the *Serial* Catalogue, as originally proposed for the Society's Library, is now in progress of rearrangement in alphabetical order according to author's names, to be followed by an alphabetical Index according to subjects. The preliminary questions regarding the type, and the form and size of the pages, having been discussed and agreed upon with the authorities of the Stationery Office, the first portion of the manuscript, containing the titles of all memoirs having the letter A as the first letter of the author's name, has been prepared, and is now placed in the printer's hands, so that the printing may be forthwith commenced.

In the meantime the endeavours to render the work more complete have not been relaxed; the number of titles, which in my last year's Address was stated to exceed 180,000, has been since extended to 213,000; and will continue to be augmented whilst the printing is in progress. It is proposed that all titles which should not be in time to be entered under their respective alphabetical heads shall be included in a supplementary

volume, which shall also comprise the titles of memoirs which must be regarded as Anonymous, having been published without the author's name. The original Serial Catalogue prepared in manuscript for the use of the Fellows of the Society still remains in the Library; and it is with great satisfaction that I am able to add that the Library itself already possesses the Transactions, Journals, and other periodical works in which two-thirds of the 213,000 titles already collected for the Catalogue are contained; and that every endeavour is making to render the Library as complete as possible in this important branch of scientific literature.

The total expenses hitherto incurred in the preparation of the Catalogue amount to £1626; and to this a small annual addition will be required until the printing and publication shall have been completed.

The Fellows of the Royal Society, and those especially who are interested in the progress of Sidereal Astronomy, will hear with pleasure that the communications, passing through Her Majesty's principal Secretary of State for the Colonies, between Sir Henry Barkly, K.C.B., F.R.S., Governor of the Colony of Victoria, and the President and Council of the Royal Society, regarding the establishment at Melbourne of a telescope of great optical power for the observation of the Nebulæ and multiple stars of the southern hemisphere, have led to a vote which has passed the Legislature of Victoria of £5000 for a suitable telescope, to be constructed under the superintendence of the President and Council of the Royal Society. In the Anniversary Address in 1862, and again in that of 1863, I availed myself of the opportunities then afforded of making known to the Fellows the progress of the communications which at each of those dates had taken place between the Government of Victoria, the authorities of the Melbourne Observatory, and the Royal Society; and I have now the satisfaction of laying before you the following letter, received on the 23rd of last month from Professor Wilson, Honorary Secretary of the Board of Visitors of the Melbourne Observatory:—

"The University, Melbourne, Aug. 21, 1865.

"My dear Sir,

"It is with very great satisfaction that I forward to you the following resolutions of the Board of Visitors adopted on the 15th inst.:—

"1. That the President of the Royal Society of London be informed that the Legislature of Victoria has voted the sum of £5000 for the purchase of an equatorial telescope, one half of which sum has been already remitted to the Crown Agents in England, and placed at the disposal of Major Pasley, of the Royal Engineers, for the purpose; and that the Government has placed the correspondence connected with it in the hands of the Board of Visitors.

"2. That the President and Council of the Royal Society be requested to give the Board of Visitors the benefit of their assistance in selecting a maker, settling the contract, and superintending the construction of the

telescope, so as best to carry out the recommendations contained in the Report of the Royal Society to the Duke of Newcastle, 18th December 1862.

"3. That Major Pasley be requested to place himself in communication with the President and Council of the Royal Society, and, after ascertaining their views, to enter into such contract as will most effectually carry them out.

"I enclose also a copy of a letter received from the Treasury, on which the foregoing resolutions are based, and a copy of the letter which I send to Major Pasley by this mail.

"The great interest which you have shown in this matter leads the Board of Visitors to count confidently on your further assistance in bringing it to a successful conclusion. The request contained in the second resolution is not intended to imply that in the opinion of the Board any further discussion as to the form of telescope or the maker is necessary. The Board thinks, and I believe that it is also your opinion, that the discussion which has already taken place has settled that question, and that Mr. Grubb's proposal should be adopted. This is not distinctly expressed in the resolution, because Mr. Grubb's name is not mentioned in the Report of the Royal Society, and because the Board desires to leave you free in the event of anything having happened to Mr. Grubb, or of any discovery having been made which would tend to modify your opinion.

"In any case the Board, bearing in mind the great length of time that has elapsed since the proposal for a telescope was first made, and having now received authority from the Government to act in the matter, is desirous of securing the completion of the telescope at the earliest possible time consistent with the highest attainable perfection in the instrument; and considers that this end will be most effectually secured by leaving you quite free to act in the matter, and trusting to you to secure the co-operation of those eminent practical astronomers whose names you mentioned as willing to superintend the work during its execution.

"Mr. Grubb's last estimate is £4600 for the telescope complete; and this, I believe, covers everything, including the erection in Ireland for a trial.

"The sum voted is £5000, and the balance, £400, will be available for a spectroscope and for a photographic apparatus adapted to the telescope, and will still probably leave sufficient to pay the freight to Melbourne. As these two adjuncts will not occupy long in making, it will probably be desirable not to commence them till the telescope proper is approaching completion, so that the latest improvements may be introduced into them.

"Trusting to your earnestness to induce you to undertake the great amount of trouble we are imposing upon you,

"I remain, my dear Sir,

"Very faithfully yours,

"W. P. Wilson,

"*Hon. Sec. to the Board of Visitors.*"

"*Major-General Sabine, R.A.,*
Pres. R.S."

To the information contained in this letter I have now the satisfaction of being able to add that since its receipt Mr. Grubb has signified his readiness to proceed in the construction of a telescope corresponding to the specification contained in his letter to Dr. Robinson of Dec. 3, 1863, printed in the second portion of the correspondence respecting the Southern Telescope,—the execution to be under the supervision of the Earl of Rosse, Dr. Robinson, and Mr. Warren De la Rue, who, on their parts, have accepted the responsibilities of superintendence. The contract between the Crown Agent for Victoria and Mr. Grubb is in process of execution, and in eighteen months from its date we may hope that the telescope will be in readiness to be embarked for Melbourne, where in the meantime preparations will be made for its reception and mounting. The selection of an Astronomer fitted by education and acquirements to be entrusted with its use at Melbourne, and who may be willing to devote his entire energies to the cultivation of the splendid field which will be open to him, must be the next anxious and important duty devolving upon the Melbourne authorities. If in its execution they should require any assistance from the Royal Society, such assistance will assuredly be most readily given.

The arrangements connected with this subject being so far advanced, I have thought it desirable to place on record a consecutive statement of the steps by which they have been brought to their present stage; and I have done this in the form of a Note (Note A)*, to avoid trespassing unnecessarily upon your present attention.

The welcome intelligence has been received from Colonel Walker, F.R.S., Superintendent of the Trigonometrical Survey of India, of the safe arrival in that country of the Pendulums prepared for the experiments which it is proposed to make at the principal stations of the survey, and of the vacuum-apparatus in which the pendulums are to be vibrated. As it has been proposed to make the Kew Observatory the Base Station of the important observations which may be made with these instruments in many parts of India, a full and very careful series of Base observations were made with them at Kew before their departure for India. These have been printed in the Proceedings of the Royal Society in the present year in the form of a communication from Messrs. Balfour Stewart and Loewy.

In the course of the last Session an important paper was communicated to the Society, and has been since printed in the Philosophical Transactions for 1865, Art. V., entitled "On the Magnetic Character of the Armour-plated Ships of the Royal Navy, and on the Effect on the Compass of particular arrangements of Iron in a Ship," by Staff-Commander Frederick John Evans, R.N., F.R.S., Superintendent of the Compass Department of Her Majesty's Navy, and Archibald Smith, Esq., F.R.S.

In the course of the reading of this paper, and in the discussion which

* See note A, p. 503.

followed it, the absence of any proper provision for the instruction or guidance of the builders, fitters, and navigators of the ships of our mercantile marine was strongly dwelt upon. It is well known that the number of iron ships recently constructed greatly exceeds that of wood-built ships. In such vessels iron is now used, not only in the construction of the hull, but in decks, deck-houses, masts, rigging, and many other parts of the ship, for which wood was till recently used. The consequence has been a great increase in the amount of the deviation of the compass, increased difficulty in finding a suitable place for the compass, and an increased necessity for, and difficulty in, applying to the deviation either mechanical or tabular corrections.

Many recent losses of iron steamers have taken place, in which there is reason to believe that compass-error occasioned the loss. In most of these, however, from the want of any record of the magnetic state of the ship, of the amount of the original deviation, and of the mode of correction—and from the investigations into the causes of the loss having been conducted by persons uninformed or not interested in the science, and who are necessarily incompetent therefore either to elicit the facts from which a judgment can be formed, or to form a judgment on those facts which are elicited—no certain conclusion as to the cause of the loss can be arrived at. The investigations are, however, sufficient to show the want of a better and more uniform system of compass-correction in the mercantile marine, and of more knowledge of the subject on the part of those who are entrusted with the fitting and navigation of these ships.

Acting in conformity with the opinions expressed in the discussion which followed the reading of the paper by Commander Evans and Mr. Smith, and availing themselves of the counsel of those who are justly regarded as possessing the greatest practical experience on such subjects in this or any other country, the President and Council addressed a letter to the President of the Board of Trade, bringing under his consideration a subject which they have reason to believe is of pressing importance, requiring that measures of a more stringent and effective character should be taken in the direction already followed by Her Majesty's Government in such legislative enactments as those contained in the Merchant Shipping Act of 1854; and, impelled by a strong conviction of the impending danger, they have ventured to suggest the expediency of steps being taken for the mercantile marine similar in character to those which have been found to work so successfully in the Compass Department of the Royal Navy.

The lamented decease of the late Admiral FitzRoy induced a desire on the part of the Board of Trade to review the past proceedings and present state of the department of that Board which had been placed under Admiral FitzRoy's direction. Adverting to the fact that at the formation of that Department the Board of Trade had requested the opinion of the Royal Society as to what might then be considered the great

desiderata in Meteorological Science, and had received in reply a letter from the President and Council (dated February 22, 1855) containing recommendations which were eventually adopted as the basis of the proceedings of the Meteorological Department of the Board of Trade, the Board was now desirous of being informed to what extent those objects had been fulfilled by what had already been accomplished, and whether the objects which had been so specified were still considered as important for the interests of science and navigation as they were then considered.

The Board of Trade were also desirous of obtaining an opinion from the Royal Society regarding the Forecasts of Weather and the Storm Warnings which had not been included in the original recommendations of the Royal Society, but had originated with Admiral FitzRoy himself and had formed a considerable part of the duties of the Meteorological Department since 1859.

To enable the President and Council to form a judgment on the questions referred to them, the Board of Trade supplied them with the following documents :—

1. Admiral FitzRoy's Report to the Board of Trade, dated May 1862.
2. A Report by Mr. Babington (Admiral FitzRoy's first assistant) on the method adopted in the department with regard to forecasts and storm-warnings.
3. A return to the House of Commons, dated April 13, 1864, presenting a comparison of the probable force of the wind as indicated by the signals in the year from April 1, 1863, to March 31, 1864, and its actual state as reported in the three days following the exhibition of the signals.
4. A manuscript return, furnished by Mr. Babington, having the same object for the year from April 1, 1864, to March 31, 1865.

The first of these documents contained the opinions of the Shipmasters at several ports on our coasts, officially requested and given, in regard to the practical value which they attached to the storm-warnings. Of these replies, by far the greater number were decidedly favourable, three only out of fifty-six being decidedly unfavourable. The date of the Report containing them was May 1862 ; and the two subsequent Reports, dated respectively in 1864 and 1865, exhibited in comparison a marked improvement in successive years. Upon the authority of those statements, and viewing the system of forecasting which Admiral FitzRoy had instituted simply (as described by himself) as "an experimental process," based on the knowledge conveyed by Telegraph of the actual state of the winds and weather and other meteorological phenomena within a specified area, and on a comparison of these with the telegrams of the preceding days, so as to obtain inferences as to the probable changes in the succeeding days—taking into account also the evidence supplied of the improvement in the forecasts of each year compared with those of the preceding year—the President and Council were of opinion that it was not unreasonable to anticipate that the system, so far at least as regarded the storm-warnings, if

continued, might receive still further improvement; and that possibly the best arrangement at the present time would be that this branch of the duties of the office should continue as at present, and be carried on under the direction of Mr. Babington, by whom it had been virtually superintended for several months past.

With reference to those branches of inquiry which had been originally suggested by the Royal Society in the letter of the President and Council of February 22nd, 1855, the reply, as might reasonably be expected, was of a more decided character. The most prominent amongst the objects recommended in that letter was the collection and coordination of facts bearing on what may perhaps not improperly be termed Oceanic Statistics,—viz. all such facts as are required to enable a correct knowledge to be formed of Currents of the Ocean, their direction, extent, velocity, and the temperature of the water relatively to the ordinary ocean temperature in the same latitude, together with the variations in all these respects which currents experience in different parts of the year and in different parts of their course. These, as well as the facts connected with the great persistent barometric elevations and depressions which we know to exist in several oceanic localities, leading to a knowledge of their causes, as well as of their influence on circumstances affecting navigation, were noticed in the letter of February 1855 as inquiries well deserving the attention of a country possessing such extensive maritime facilities and interests as ours, and as likely to form a suitable contribution on our part to the general system of meteorological inquiry which had then recently been adopted by the principal continental states in Europe and America.

It was learnt from Mr. Babington that much had been done by Admiral FitzRoy in the three or four years succeeding the establishment of his office (and before the subject of storm-warnings had engrossed the greater part of his thoughts), in directing the attention of many of the commanders of our merchant ships to the collection of suitable data, and in improving their habits of observation and of record. The logs of such vessels, we were informed, constitute at present a large collection of documents existing in the office of the Board of Trade, partially examined, and their contents partially classified. A full and careful examination of these for the purpose of ascertaining the amount and value of their contents was our first recommendation, to be combined with a consideration of the most fitting mode in which the information they might be found to contain may be made available for public use. Such an examination may also be expected to lead to improvements in the instructions which have been issued to our merchant seamen, who have doubtless become more competent to conduct, and even to extend, the observations for these and similar purposes, than when the system was first introduced. Those amongst us who have read with the attention it deserves the admirable paper in which Captain Henry Toynbee has enriched our Proceedings in the past year with the results of his five Indian voyages, will not doubt the

competency or the disposition that may exist amongst our merchant seamen to collect materials of the highest value for the investigations which the President and Council originally recommended; and we can entertain no doubt that, whatever may prove to be the amount and value of the materials already collected, they will form but a small contribution towards that general embodiment of the statistics of the ocean which the great increase of our commercial activity makes of pressing importance, and which may be expected to shorten materially the passages between distant ports.

The Board of Trade were also desirous to know whether the Royal Society has any recommendations to make with reference to what may be called "Meteorology proper," viz., meteorological observations to be made *on land*, in addition to the marine observations which were so strongly urged in the letter of the President and Council of February 1855.

The reason why the advantages to be derived from a well-directed system of *maritime* observations was more particularly pressed on that occasion was, that neither the instruments nor the modes of observation suitable for a well-organized, general, and efficient system of land meteorology had been then prepared. The circumstances which constituted the difficulty in this respect were well stated by Lieut. Maury in a letter addressed to the United States Government, dated November 6, 1852, subsequently transmitted by the American minister to the Earl of Clarendon, and printed in the papers preceding the Brussels conference, which were presented to the House of Lords in February 1853. This difficulty no longer exists, having been wholly obviated by the self-recording system of observation, for which the necessary instruments have been devised and brought into use at the Kew Observatory.

The President and Council have had therefore no hesitation in expressing the opinion that systematic meteorological observations at a few selected land stations in the British Islands are desirable, in addition to the marine meteorological observations, in order to complete a suitable contribution from this country to the meteorological observations now in progress in the principal states of Europe and America, under the authority of their respective Governments. A few stations, say six, distributed at nearly equal distances in a meridional direction from the south of England to the north of Scotland, furnished with *self-recording* instruments supplied from and duly verified at one of the stations regarded as a central station, and exhibiting a *continuous* record of the temperature, pressure, electric and hygrometric state of the atmosphere, and the direction and force of the wind, might perhaps be sufficient to supply an authoritative knowledge of those peculiarities in the meteorology of our country which would be viewed as of the most importance to other countries, and would at the same time form authentic points of reference for the use of our own meteorologists. The scientific progress of meteorology from this time forward requires indeed such continuous records—first, for the sake of the knowledge which they alone can effectively supply, and next for the comparison with the

results of independent observation not continuous. The actual photograms, or other mechanical representations, transmitted periodically by post to the central station might be made to constitute a lithographed page for each day in the year, comprehending the phenomena at all the six stations—each separate curve admitting of exact measurement from its own base-line, the precise value of which might in every case be specified.

The President and Council have added a suggestion that the Observatory of the British Association at Kew might, with much propriety and public advantage, be adopted as the central meteorological station. It already possesses the principal self-recording instruments, and the greater part of these have been in constant use there for many months. There would be no difficulty in obtaining similar instruments for the affiliated meteorological stations, and in arranging for their verification and comparison with the Kew standards, as well as in giving to those into whose hands they may be placed, such instructions as may ensure uniformity of operation.

You are aware that Royal Princes, Foreign as well as British, who signify their desire to enter the Society, and are proposed accordingly, are understood to be entitled to immediate ballot. On a late occasion, however, it was found that, according to the strict letter of the statutes, the head and representative of a Royal House might be inadmissible by privileged election, whilst members of the same family of inferior rank were entitled to it. His Royal Highness the Count of Paris having expressed a desire to join our body, it appeared on referring to the Statutes, that although he is the son of the late Duke of Orleans and hereditary representative of the late King of the French, yet, inasmuch as his father had not been a "sovereign prince," the Society was precluded from showing him a courtesy which it may extend to other members of his family who look up to him as the head of their house. The Council, believing that the Society would desire to see this anomaly corrected, took, after due deliberation, the prescribed steps for amending the Statute; and being advised that the usage of Her Majesty's Court would afford a suitable criterion of rank applicable to the case, introduced words extending the privilege in question to "any foreign Prince who is received by Her Majesty as Imperial Highness or Royal Highness." The unanimous election of the Count of Paris under the amended Statute may, I think, be taken as a ratification of the act of the Council.

I am glad to avail myself of this opportunity of stating that the reduction of the automatic records of the bifilar magnetometer at Kew during the seven years from 1858 to 1864 inclusive has now been completed, so far as to make known the relative amount of magnetic disturbance in each of those years. The results are shown in a note (B)*, by which it will be seen that 1859 was a year of decided maximum, the aggregate disturbances in that year being considerably greater than in 1858, and dimi-

* See note B, p. 512.

nishing progressively from 1859 to 1863–1864: in 1863 and 1864 the amount of disturbance was nearly identical, and was only about one-third of the amount in 1859. From the general aspect of the photographic traces in the present year (1865), there appears reason to believe that the epoch of minimum is now passed. If this be so, the years 1863–64 will have been the fourth return of the epoch of minimum since 1823-24 (Arago's Meteorological Observations, English translation, Editor's Note, pages 355 to 357), thus confirming the coincidence with the *decennial* variation of the sun-spots discovered by Schwabe.

Those who regard with interest the progressive establishment of the theory which assigns a cosmical origin to the Terrestrial Magnetic Variations, will have noticed the remarkable, but not altogether unanticipated, testimony borne to the decennial variation by the annual values of the magnetic Inclination at Toronto in the years from 1853 to 1864, in the volume recently published by Mr. Kingston, Superintendent of that Observatory. The general effect of the disturbances of the Inclination at Toronto is to increase what would otherwise be the amount of that element; therefore, if the disturbances have a decennial period, the absolute values of the Inclination (if observed with sufficient delicacy) ought to show in their annual means a corresponding decennial variation, of which the minimum should coincide with the year of minimum disturbance, and the maximum with the year of maximum disturbance. I have placed in a note (C)* the annual values derived in each case from the regular monthly determinations, commencing with 1853, and ending with 1864, taken from the publication referred to, whereby it will be seen that an actual variation does exist such as I have indicated, 1853 being a minimum and 1859 a maximum; the increasing progression being uninterrupted from 1853 to 1859, and the decreasing progression uninterrupted from 1859 to 1864, the date of the latest published results.

It was in the year 1853 that the Toronto Observatory was transferred to the provincial authorities, and was placed by them under the direction of Mr. Kingston. The Inclinometer employed is the same which was described in a paper in the Philosophical Transactions for 1850, Art. IX., entitled "On the Means adopted in the British Colonial Magnetic Observatories for determining the Absolute Values, Secular Changes, and Annual Variations of the Terrestrial Magnetic Elements;" and the assistants by whom the observations were made were the same persons who had performed the same duties when the Observatory was under the direction of Officers of the Artillery. The results are a valuable exemplification of the accuracy attainable when proper attention is paid to the selection of the instruments, and to the employment of careful and skilful observers. Such evidence is of more than ordinary interest at the present time, when such institutions are rapidly increasing.

We have recently learned by a despatch from Sir H. Barkly, Governor of

* See note C, p. 513.

Mauritius, to the Secretary of State for the Colonies, a copy of which has been transmitted to the Royal Society by Mr. Cardwell, that arrangements have been made and funds provided for a magnetical and meteorological observatory in that colony, on the model of the Kew Observatory; and that Professor Meldrum, who has been appointed its superintendent, may be expected immediately at Kew to receive the instruments which have been prepared by Mr. Balfour Stewart, and to make himself acquainted with the details both of instruments and methods in use at that observatory. We have also reason to hope that the example thus set at Mauritius will shortly be followed at Melbourne and at Bombay.

A summary of the results arrived at in discussing the Solar Autographs taken at the Kew Observatory with the Photoheliograph belonging to the Royal Society has appeared in the 'Proceedings;' and the Fellows have thus been made acquainted, in a general way, with the conclusions which have been based on the observations so obtained. The state of the atmosphere permitting, pictures of the sun are taken daily by Miss Beckley, daughter of the resident mechanical assistant; and these are as regularly measured and discussed by Dr. Loewy. In this way has been accumulated a vast mass of materials on which to found conjectures as to the nature of the physical forces operating at the surface of the sun; and, taking these materials as a basis, Messrs. De la Rue, Stewart, and Loewy have drawn the conclusions enunciated in their several papers on solar physics. It is, however, by no means improbable that other investigators, could they obtain access to the same full and complete details of the observations and measurements, would succeed in evolving other and most important theories of solar activity, and thus that our knowledge of the subject might be greatly advanced. It is moreover evident that in a method of observation so new, and in a subject so intricate, the minutest fact can hardly be dismissed as insignificant, seeing that, whatever its present apparent isolation, it may hereafter be shown to stand connected with an important series of facts, towards a right theory of which it may indeed furnish important aid. It has therefore to be considered in what way the publication of these voluminous details can be best effected. Pending this, however, I am glad to state that the authors above-named have themselves determined to print in detail their first paper, and that a sufficient number of copies will be placed at the disposal of the Society for distribution among the Fellows.

The amount of spotted area is being measured; and the elements of the sun's rotation will be calculated from the spots.

Those of the Fellows who are interested in the trial of gun-cotton as a propellant, will be glad to learn that its employment as a charge for the Whitworth and Enfield Rifles is progressing favourably. By a mode of construction of the cartridge ingeniously devised to control the too great rapidity of combustion, the cotton is found to command, without injury to

the rifle, a range fully equal to that of powder, and, in experiments at the School of Musketry at Hythe, under the superintendence of Major-General Hay, has made excellent shooting, producing diagrams at 1000 yards, hardly, if at all, inferior to those obtained from the best small-bore rifles of the day. These diagrams were obtained with a Whitworth Rifle: in the first, 10 consecutive shots were fired at 1000 yards, with a mean radial deviation of 1·65 foot; in the second, 9 consecutive shots at 1000 yards, giving a mean radial deviation of 2·02 feet. And in the third, 20 consecutive shots were fired at 1000 yards, giving a mean radial deviation of 2·43 feet. The charge in all cases was 25 grains of gun-cotton, the angle varying from 3° to 3° 3′.

The cartridges with which these shots were fired were made *by hand*: the defect of cartridges so made is obvious, viz., that they may not be strictly uniform. But this is an inconvenience remediable by the employment of very simple machinery.

In preliminary trials above 2000 rounds have been fired out of one and the same rifle, without occasioning the slightest injury to the piece.

The advantages of the cotton charges were manifest in the diminution of recoil and smoke, and in the entire absence of fouling.

The demand for cotton charges for sporting-purposes has become very considerable since the shooting-season commenced, and they are understood to have given very general satisfaction.

It is not unreasonable to anticipate that the principles of construction of the cartridges which have proved so successful in the adaptation to small arms, may eventually, with suitable modifications, make cotton available for iron ordnance, as a substitute, in a greater or less degree, for powder, which is far more dangerous in manufacture and storage. As far as has been yet tried, the cotton is found to keep perfectly well for any length of time submerged in distilled water.

I proceed to the award of the Medals:—

The Council has awarded the Copley Medal to M. Michel Chasles, For. Mem. R.S., for his Historical and Original Researches in Pure Geometry.

The historical and original researches of Chasles extend over a period of about forty years. Throughout this time he has devoted his energies, with a constancy of purpose rarely equalled, to the restoration and extension of those purely geometrical methods which, bequeathed to us from antiquity, had their growth arrested during the middle ages, and their utility temporarily eclipsed by the brilliant discovery of coordinate geometry by Descartes. In his well-known 'History of the Origin and Development of Geometrical Methods,' published in 1837 and crowned by the Academy of Brussels, Chasles thus expresses what has proved to be the leading object of his life's labours:—

"I propose to show, so far as my feeble means will permit, that in a multitude of questions the doctrines of pure geometry most frequently present to us that easy and natural path which, penetrating to the very

origin of truths, brings us into actual contact with each individual truth, and at the same time reveals to us the mysterious chain by which all are connected."

The elaborate work here quoted* is unique of its kind; it is our highest authority on all matters connected with the history of geometry, of which science it carefully traces the development from the time of Thales and Pythagoras, down to the earlier part of the present century. Although professing to be an *aperçu* merely, it nevertheless represents a vast amount of historical research, and is moreover enriched by copious notes containing the results of important original investigations.

In the year 1846 the foundation of a chair of modern geometry was decided upon by the Faculty of Sciences at Paris, and Chasles was at once chosen to supply a demand which his own researches had in a great measure created. Thus commenced that personal influence on the younger geometers of his country which still continues, and is traceable in all their productions. Another result of this appointment, by which geometers of all nations have greatly profited, was the publication, in 1852, of his 'Treatise on the Higher Geometry'†,—a work in which the three fundamental principles of pure geometry are, for the first time, fully and systematically expounded. These principles embrace the modern theories of anharmonic ratios, of homographic divisions and pencils, and of geometric involution. An anharmonic ratio is in reality a ratio of two ratios, the latter having reference to two pairs of segments determined by any four points of a line. On one peculiar property of this ratio—that of its remaining unaltered by projection—all modern geometry may be said to be founded. Homographic divisions consist of two rows of points, in the same straight line or in different ones, which so correspond that the anharmonic ratio of any four points of one row is equal to that of the corresponding points of the other row. Finally, two homographic rows, in the same straight line, are said to form an involution when to any point whatever of that line one and the same point corresponds, no matter to which of the two rows the first point may be conceived to belong. Usually there are two points in such an involution, each of which coincides with its own corresponding point; by a mere accident of position, however, the actual existence of these *double points* may be destroyed, whilst all other properties of the involution remain intact. In this contingency originated a mode of speech of the greatest utility in geometry. The double points are said to be *real* in the one case, and *imaginary* in the other. For the undisguised and philosophic introduction of imaginary points and lines into pure geometry we are chiefly indebted to Chasles.

* Aperçu historique sur l'origine et le développement des méthodes en Géométrie, particulièrement de celles qui se rapportent à la Géométrie Moderne; suivi d'un Mémoire de Géométrie sur deux principes généraux de la science, la dualité et l'homographie. Bruxelles, 1837. German translation by Dr. Söhncke; Halle, 1837.

† Traité de Géométrie Supérieure. Paris, 1852.

The term anharmonic ratio, now universally employed, is due to Chasles; the ratio itself, however, appears to have been known to Pappus, the eminent Alexandrian geometer of the fourth century. Chasles, indeed, has shown that this ratio probably constituted an essential feature of those three famous books on Porisms, which Euclid is known to have written, but of whose nature vague indications merely have been transmitted to us in the mathematical collections of Pappus. Robert Simson of Glasgow, the well-known translator of Euclid's 'Elements,' was the first who satisfactorily solved the enigma concerning the real nature of Porisms, and he also succeeded in partially restoring the three lost books. Chasles, however, was the first to restore them completely; and this he has done in a work* which is admitted to be a valuable addition to the history of geometrical science, as well as a model of ingenious and philosophical divination.

Chasles has contributed to the advancement of pure geometry, not only by means of the three complete works already alluded to, but also through the publication of numerous smaller memoirs. Of these the following, by no means the only important ones, demand a passing reference.

The papers on "Stereographic Projections" converted a method originally devised for the construction of maps into a powerful instrument of geometrical transformation. Two able memoirs on "Cones of the Second Order" and on "Spherical Conics," thanks to the translation, published in 1841, by Dr. Graves of Trinity College, Dublin, had a direct influence on pure geometry in our own country. A paper "On the Correspondence between Variable Objects" furnished us with a principle of the greatest utility in all higher geometrical investigations. In several other memoirs the method of generating curves of higher orders by means of homographic pencils of curves of inferior orders is perfected, and new properties are thereby deduced of plane curves of the third and fourth orders. The theory of non-plane curves, especially those of the third and fourth orders, had its origin, for the most part, in Chasles's memoirs; and the modern science of kinematics is indebted to him for two valuable papers on the finite and infinitesimal displacements of a Solid Body. The problem of the attraction of Ellipsoids, rendered celebrated by the investigations of Newton, Maclaurin, Ivory, Legendre, Lagrange, and Laplace, received from Chasles its first complete *synthetical* solution. In this problem, too, originated the conception of confocal surfaces of the second order, the theory of which he has since greatly perfected.

The first volume of Chasles's fourth work (a Treatise on Conic Sections†) appeared during the present year: it is a sequel to his 'Higher Geometry;'

* Les trois livres de Porismes d'Euclide, rétablie pour la première fois, d'après la notice et les lemmes de Pappus, et conformément au sentiment de R. Simson sur la forme des énoncés de ces propositions. Paris, 1860.

† Traité des Sections Coniques, faisant suite au traité de Géométrie Supérieure. Paris, 1865.

and in it the three principles already alluded to find their most appropriate field of application. The second volume of this treatise is looked forward to with interest, as it will contain a full exposition of the admirable researches on conic sections wherewith Chasles has just crowned his labours. These researches, a brief account of which appeared during the past year in the pages of the 'Comptes Rendus,' have put us in possession of an entirely new method, the nature and utility of which may be rendered intelligible even to those who have not made modern geometry a subject of special study.

For the determination or construction of the curves usually called conics, and of which the hyperbola, parabola, and ellipse are species, five conditions are requisite and, in general, sufficient. The nature of these five conditions may be such, however, as to admit of their being satisfied by more than one conic. For instance, although one conic only can be described through five given points, there exist two distinct conics, each of which passes through four given points, and touches a given line. Hence arises the important general question, *How many conics are there capable of satisfying any five conditions whatever*? By the new method of Chasles we are enabled to answer this question, hitherto a difficult one, with great facility. Starting from the elementary cases where the five conditions are of the simplest possible kind, consisting solely of passages through points and contact with lines, he gradually replaces those conditions by more complex ones, and finally arrives at a simple symmetrical formula which fully answers the above question. Seeing how numerous are the questions in conics which may be ultimately reduced to the one here solved, we may, without exaggeration, assert that in this single formula a great part of the entire theory of conics is virtually condensed.

The method has been aptly termed by its eminent discoverer a method of *geometrical substitution*. It involves the consideration of the properties of a system of conics (infinite in number) satisfying *four* common conditions. Such a system is for the first time defined in a manner closely analogous to that in which curves are distinguished into orders and classes. We merely require to know, *first*, how many conics of the system pass through an arbitrarily assumed point, and, *secondly*, how many of them touch any assumed line. These two numbers or *characteristics*, as they are termed, being once found, all the properties of the system of conics are thereby expressible. For instance, the sum of twice the first characteristic and three times the second gives us the order of the curve upon which the vertices of every conic of the system are situated.

This new method of characteristics has been already applied to curves of higher orders, as well as to surfaces; and, considering the magnitude of the new fields of investigation thus opened out, it is probable that, as an instrument of purely geometrical research, the method of Chasles will bear comparison with any other discovery of the century.

PROFESSOR MILLER,

M. Chasles being prevented from being present in person to receive the Medal which has been awarded to him, I have to request you as our Foreign Secretary to receive it for him, and to transmit it into his hands. It will assure him of the very high estimation in which his labours, in a branch of mathematical research which for more than a century has been little followed and little encouraged, are held in this country.

The Council has awarded a Royal Medal to Joseph Prestwich, Esq., F.R.S., for his numerous and valuable Contributions to Geological Science, and more especially for his papers published in the Philosophical Transactions, on the general question of the Excavation of River Valleys; and on the Superficial Deposits in France and England, in which the Works of Man are associated with the Remains of Extinct Animals.

It is now not less than sixteen years since the Geological Society awarded to Mr. Prestwich the Wollaston Medal, the highest honour in their gift, for the researches and discoveries he had then made; and it may be said without disparagement to the services he had then rendered to geology, that the works he has since completed and published greatly outweigh in amount and value what he had achieved in 1849.

Before that time his writings comprised memoirs both on the palæozoic and tertiary strata:—one on the Old Red Sandstone strata containing ichthyolites, and on some beds of the glacial period at Gamrie; and another, a very elaborate one, on the coal strata of Coalbrook Dale, in which he explained in detail the structure of that coal-field, and the arrangement and distribution of the fossils throughout a long succession of the carboniferous strata. In the tertiary formations he introduced a considerable reform in the classification of the English series by proving, amongst other points, that the central division of the Bagshot Sands coincided in date with the "calcaire grossier" of the Paris Basin, instead of occupying, as was before supposed, a much higher place in the series.

After 1849, continuing his researches on the English tertiary formations, he made two other important steps in the advance of our knowledge, viz., 1st, by showing that the clays of the Island of Sheppey, those of Barton, and those of Bracklesham, in Hampshire, instead of being all three contemporaneous, according to the then received opinions, were each due to a separate period,—an important rectification of the chronological order of the British tertiary formations; and, 2nd, by pointing out that beneath the fluviatile beds of Woolwich, or that series commonly called the plastic clay and sands, there existed an older marine formation, for which he proposed the name of the Thanet Sands—a subdivision now generally recognized and adopted. By establishing the true position of this subdivision, a decided step was made towards filling up the wide gap which still divides the lowest of our Eocene strata from the Maestricht beds or upper part of the chalk.

After completing these and other papers, too many to enumerate here, Mr. Prestwich undertook the more difficult and complicated task of correlating the successive tertiary formations of England, France, and Belgium; and communicated the results in Memoirs published in the Geological Society's 'Journal,' embodying the fruit of many years of travelling and much thought and study.

In 1851 Mr. Prestwich published a separate work on the water-bearing strata around London, facilitating the subterranean search for water by giving actual measurements and probable estimates of the thickness of the chalk and other beds immediately above and below the chalk, and suggesting means of obtaining an additional supply of water for the metropolis.

In 1859 Mr. Prestwich presented to the Royal Society a highly important memoir on the occurrence of flint-implements associated with the remains of animals of extinct species in France and England; and another paper in 1863, on the theoretical questions connected with the same subject.

In these memoirs, as generally throughout all his writings, Mr. Prestwich has exhibited in a very marked degree a combination of unwearied labour and patience in the accumulation of facts, with a remarkable impartiality of judgment in the deduction of their bearing on the existing state of knowledge,—a combination, the value of which cannot be too highly estimated.

Mr. Prestwich,

I present you with this Medal in testimony of the high sense entertained by the Council, and specially by those Members of the Council who are engaged in the same pursuits as yourself, of your laborious researches, and of the spirit in which they have been conducted, in the rectification of many important points in the geology of this and of neighbouring countries, and in tracing out the facts of the occurrence of implements, the work of man's labour, in association with the remains of extinct animals.

The Council has awarded a Royal Medal to Archibald Smith, Esq., F.R.S., for his papers in the Philosophical Transactions and elsewhere on the Magnetism of Ships.

The irregularities to which ships' compasses are liable from the disturbing influence of the iron contained in the ship, originally noticed by the astronomer Wales in the voyages of Captain Cook, and subsequently by Flinders at the commencement of the present century, attained a magnitude in the first of the polar voyages of discovery, viz. that of 1818, which forced on the attention of those who were responsible for the navigation of the vessels the indispensable necessity of meeting and surmounting the difficulties and dangers occasioned thereby. Having been attached to the two first of these expeditions to take charge of all matters of a scientific character, this duty devolved more especially on myself; and before the expedition of 1819 quitted the northern shores of Britain (those of the Shetland Islands), two leading characteristics of modern practice—the

establishment of a standard compass, in a fixed and suitable position, by which compass alone the ship's course should be directed and all bearings should be taken, and the formation of a table of deviations on the several points of the compass by the method now so universally practised of swinging the ship—were adopted in both the 'Isabella' and the 'Alexander.' The systematic character of the deviations, unprecedented in amount, which were experienced by these ships in subsequent parts of their voyage, attracted the attention of an eminent French geometrician, Poisson, who published, in 1824, two papers in the Memoirs of the French Institute, containing a mathematical theory of magnetical induction, with formulæ involving coefficients to be determined by observation, expressing the action of the soft iron of a ship upon her compass—and, in a subsequent memoir, adapted the formulæ to observations made on shipboard sufficient in number to determine the coefficients in the particular case of the soft iron being symmetrically distributed on either side of the principal section of the ship. The application of these formulæ was verified by deviations calculated for different positions in the high northern latitudes, where the absolute values of the magnetic elements, as well as the deviations of the compass on board, had been observed by the polar ships, the observed and calculated deviations showing a remarkable accordance.

About twenty years after the date of the Arctic voyages, the system of compass-correction, which had been so successfully practised in the ships engaged in those voyages, was definitely adopted in the Royal Navy, on the recommendation of a committee appointed by the Admiralty, including among its members two of the officers who had served on these voyages, viz. the late Sir James Clark Ross and myself.

At a somewhat later epoch the Magnetic Survey of the Antarctic regions brought into prominent view the importance and value of Poisson's theory. By far the greater part of the Survey having to be executed by daily observation of the three magnetic elements on shipboard, it became desirable for the deduction of the results, that the fundamental equations of Poisson's theory should receive such a modification as should adapt them to the form in which the data generally present themselves. This was the first great service which Mr. Smith rendered towards the correction of the irregularities occasioned by the magnetism of ships. Himself a mathematician of the first order, and possessing a remarkable facility (which is far from common) of so adapting truths of an abstruse character as to render them available to less highly trained intellects, he derived, at my request, from Poisson's fundamental equations, simple and practical formulæ including the effects both of induced magnetism and of the more persistent magnetism produced in iron which has been hardened by any of the processes through which it has passed. These formulæ supplied the means of a sufficiently exact calculation when the results of the Survey were finally brought together and coordinated. They were subsequently printed in the form of memoranda in the account of the Survey in the

'Phil. Trans.' for 1843, 1844, and 1846. Instances occurred during the Survey, and are recorded in the account, in which (although these were not *iron* ships) the difference of the pointing of the compass on different courses exceeded 90°; the differences almost entirely disappearing when Mr. Smith's formulæ were applied.

The assistance which, from motives of private friendship and scientific interest, Mr. Smith had rendered to myself was, from like motives, continued to the two able officers who have successively occupied the post of Superintendent of the Compass Department of the Navy; and the formulæ for correcting the deviation, which he had furnished to me, reduced to simple tabular forms, were published by the Admiralty in successive editions for the use of the Royal Navy.

As in the course of time the use of steam machinery, the weight of the armament of ships of war, and generally the use of iron in vessels increased more and more, the great and increasing inconveniences arising from compass-irregularities were more and more strongly felt, and pressed themselves on the attention of the Admiralty and of naval officers.

An entire revision of the Admiralty Instructions became necessary. Mr. Smith's assistance was again freely given, and the result was the publication of 'The Admiralty Manual for ascertaining and applying the Deviations of the Compass caused by the Iron in a Ship.'

The mathematical part of this work, which is due to Mr. Smith, seems to exhaust the subject, and to reduce the processes by simple formulæ and tabular and graphic methods to the greatest simplicity of which they are susceptible. Mr. Smith also joined with his fellow-labourer, Capt. Evans, F.R.S., the present Superintendent of the Compass Department of the Navy, in laying before the Society several valuable papers containing the results of the mathematical theory applied to observations made on board the iron-built and armour-plated ships of the Royal Navy.

Owing in great measure to these researches, the system practised in the Navy has been brought to its present advanced state.

The outline of the system may be stated briefly as follows:—

1. As regards the building of ships. It has been ascertained that the amount of disturbance is greatest in iron ships which are built (in British ports) with their heads to the North, and is still further and greatly increased in armour-plated ships when they are plated with their heads in the same direction in which they were built. It is therefore desirable that iron ships should not be built with their heads to the north, and that armour-plated ships should be plated in the reverse position to that in which they were built.

2. In respect to the fitting of ships. It is held to be essential that in every ship a *Standard Compass* should be fixed in a position selected, not for the convenience of the helmsman or of the builder, but for the moderate and uniform amount of the deviation at and around it, and where every facility exists for the examination of errors, by comparison

with the azimuths of celestial objects, or by terrestrial bearings. No iron of any kind should be placed, or should be suffered to remain, within a certain distance of the Standard Compass; in the British naval service this distance is 7 feet: and all vertical iron, such as stanchions, arm-stands, &c., should be at a still greater distance; in the British naval service this distance is 14 feet,—whether on the same deck or immediately below it.

It is not difficult to select a place where the Standard Compass can be most advantageously placed; but it is difficult, and some more stringent measures are required than at present exist, to induce ship-builders to adapt the arrangements of the vessel to the requirements of the compass.

3. In respect to those who have to navigate the ship. Every iron ship should be swung when her cargo is complete, and when she is ready in all respects for sea. Tables of the deviation of the Standard Compass on each course should be made according to the directions now universally adopted in Her Majesty's Navy, the tabular deviations being applied as corrections to the courses steered. The table of deviations to be carefully watched as the ship proceeds on her voyage, by comparison with the azimuths of celestial objects, and reformed as changes in the geographical position of the ship, or in the magnetic condition of her iron, take place, according to rules which have been devised for that purpose, confirmed by experience, and published by authority.

By a strict adherence to the precautions, arrangements, and practices which have been thus briefly sketched, the compass may still, in great measure, retain its place as the invaluable guide to the mariner in iron ships, as it was formerly in wooden ships.

But with the increased employment of iron increased vigilance is required in those on whom the responsibilities devolve. The assiduous labours of several eminent men, and prominently amongst them of Mr. Smith, have placed it in the power of any intelligent seaman to navigate his iron ship with safety; but it cannot be too strongly inculcated, that *no* processes of supposed correction—whether tabular or mechanical—should be allowed to interfere with the habitual and constant practice of examining the Standard Compass, on all occasions when the state of the heavens will permit, by comparisons with celestial objects.

The benefits of Mr. Smith's labours have not been confined to our own Navy. The works to which he has contributed have been translated into the German, Russian, and French languages. The British system has been adopted in Russia, whose vessels have to navigate a sea in which the magnetic dip, and consequently the deviation of the compass, is even greater than in our own seas. A Compass Observatory has been established at Cronstadt to fulfil the same purposes as our Compass Observatory at Woolwich. Amongst our neighbours the French, whose fleets approximate the nearest to our own in the species of defensive armour which is perilous to their navigation, the system adopted in this country to preserve the utility of the compass has been the subject of a special mission appointed

by the Government, and of a Report addressed to the Minister of the Marine by M. Darondeau, entitled "Rapport à son Excellence le Ministre de la Marine sur une Mission accomplie en Angleterre pour étudier les questions rélatives à la régulation des Compas." The principal conclusions of this Report in reference to the compass by which the ship's course is to be directed, may be stated in a few words; and I shall employ for this purpose M. Darondeau's own expressions, as they are a remarkable testimony to the value of the system adopted in the British Navy.

"Établir sur tous les bâtimens un 'Standard Compass,' ou compas de relèvement à poste fixe, *qui ne serait pas corrigé*. Ce compas dévrait être assez élevé pour permettre de prendre les relèvemens par dessus le bastingage; il devrait en outre être placé dans la position la plus favorable pour n'être soumis qu'à la force totale du navire, et non aux forces perturbatrices provenant de pièces de fer isolées. Dans ce but on l'élèverait de manière à le soustraire à ces dernières forces perturbatrices.

"*Ce compas ne serait jamais corrigé.*"

The *italics* are mine; but the repetition of this last injunction is M. Darondeau's own, and is emphasized by him by being made to occupy a line by itself.

M. Darondeau also recommends the employment in the French Marine of compasses similar to the Admiralty compass of the British Navy, having four needles attached to the card in the manner and for the purposes originally suggested by Mr. Smith; and he does not fail to urge on his countrymen the indispensable duty of examining the deviations of the Standard Compass by reference to the heavenly bodies, whenever the state of the weather will permit.

Mr. Smith,

Receive this Medal which the Council has awarded you in testimony of their high sense of the value of your researches on the magnetism of ships.

I trust that you will always regard it with a real pleasure, agreeing well with the yet higher pleasure derived from the consciousness of the essential service your generous labours have rendered to the mariners of this and all other maritime nations.

I will venture on the personal expression of the high gratification which my position in this chair allows me this day to enjoy—in mine being the hand which places this Medal in that of one who from his earliest youth has been the object of my ever-increasing high esteem and warm friendship.

NOTES.

Note A.

The steps which have led to the procurement of a large reflecting telescope for active employment in the southern hemisphere originated in a resolution passed by the General Committee of the British Association assembled at Birmingham in September 1849, during the Presidency of the Rev. Dr. Thomas Romney Robinson. The resolution was as follows:—

"That an application be made to Her Majesty's Government to establish a reflector of not less than 3 feet in diameter at the Cape of Good Hope, and to make such additions to the staff of that observatory as may be necessary for its effectual working; and that the President be requested to communicate with the Earl of Rosse and Sir J. Herschel, the Astronomer Royal, Sir Thomas Brisbane, and Dr. Lloyd on the subject; and to obtain the concurrence in the application of the Royal and Astronomical Societies of London, the Royal Society of Edinburgh, and the Royal Irish Academy."

The communications thus directed having been made, the President and Officers of the British Association received on the 9th of the November following (1849) a reply from the Council of the Royal Astronomical Society, declining to cooperate with the British Association in recommending the establishment of a large reflector at the Cape of Good Hope, on the ground that "a system of observations essentially meridional, as those of the Cape Observatory now are, has very little in common with a system of observations with a large reflector. The Council conceive that the subjects and methods and difficulties of the last-mentioned observations absolutely require the entire energies of a superintendent fitted by his talents and education to be the head of an observatory. They consider therefore that the proposal in question amounts to nothing less than the establishment of a new observatory, a measure which the Council [of the Royal Astronomical Society] are not prepared to recommend."

The reply of the Council of the Royal Society of Edinburgh was dated December 10, 1849, and was as follows:—"The Council [of the Royal Society of Edinburgh] are of opinion that it is not expedient at present to take part in the proposed application to Government relative to the large reflecting telescope, suggested to be sent to the Cape of Good Hope."

No specific reply appears to have been received from the Royal Irish Academy, it having been stated in a letter from Dr. Lloyd to the Rev. Dr. Robinson, that "the Council of the Royal Irish Academy had declined to enter upon the subject, as not being strictly within the province of the Academy."

The reply from the Royal Society of London was dated April 19, 1850, and was as follows :—

"The President and Council of the Royal Society agree entirely with the British Association in their estimate of the importance of the active use of a large reflector in the southern hemisphere, and deem the subject well worthy of a recommendation to Her Majesty's Government, in which they would be ready to concur; but they would deem it advisable that, in such recommendation, the locality to which the telescope should be sent, and the establishment to which its use should be confided, should be left to the choice of Her Majesty's Government."

These replies were submitted to the Council of the British Association on the 20th of May, 1850, when the Council passed the following resolution :—

"That the object which the General Committee had in view in their resolution for a recommendation to establish a large reflector at the Cape of Good Hope, viz. the systematic observation of the nebulæ of the Southern Hemisphere with an instrument of great optical power, would be accomplished by the establishment of such an instrument in any other part of the Southern Hemisphere which should be equally suitable for the observations in question; the Council are therefore of opinion that the President will be carrying out the spirit of the recommendation of the General Committee, by putting the proposition to be made to Her Majesty's Government in the general form suggested by the President and Council of the Royal Society, and by concurring with the President of the Royal Society in submitting the recommendation so modified to the consideration of Her Majesty's Government."

The President (Dr. Robinson) was further requested to draw up a Memorial to accompany the Resolution, and to communicate thereupon with the Earl of Rosse, President of the Royal Society. The Memorial prepared by Dr. Robinson, and concurred in by the Earl of Rosse, was presented, in accompaniment with the Recommendation of the General Committee thus amended, to Earl Russell (then Lord John Russell), the First Lord of the Treasury. The Memorial itself may be referred to in the "Report of the Council to the General Committee of the British Association assembled at Edinburgh in July 1850." The reply from the Treasury was as follows :—

"Treasury Chambers, August 14, 1850.

"Sir,—I am commanded by the Lords Commissioners of Her Majesty's Treasury to acquaint you that your Memorial of the 3rd ultimo, addressed to Lord John Russell, applying, on behalf of the British Association for the Advancement of Science, for the establishment in some fitting part of Her Majesty's dominions of a powerful Reflecting Telescope, and for the appointment of an observer charged with the duty of employing it in a review of the Nebulæ of the Southern Hemisphere, has been referred by His Lordship to this Board; and I am directed to inform you with re-

ference thereto, that while My Lords entertain the same views as those expressed by you as to the interest attaching to such observations, yet it appears to their Lordships that there is so much difficulty attending the arrangements which alone could render any scheme of the kind really beneficial to the purposes of science, that they are not prepared to take any steps without much further consideration.

"I am, Sir, &c. &c.,

"G. CORNEWALL LEWIS."

This reply, though failing to meet the not unreasonable expectations which had been founded on the intrinsic importance of the subject itself and on the earnest recommendation it had received from the two principal scientific institutions of the kingdom, was still so far satisfactory that it conveyed the approval of the Government of the principle of the proposition; it was reasonable to believe therefore that by perseverance and by a judicious selection of times and opportunities the object would be eventually secured. Such was the view taken by its promoters; and in accordance with this view the subject was again brought under the consideration of the British Association at their Meeting at Belfast in September 1852, in the opening address of the President, suggesting that a decision should be taken—whether any, and if any, what official step should be adopted for its immediate furtherance. After the usual discussions in Sections and Committees, the General Committee passed the following Resolution:—

"That it is expedient to proceed without delay in the establishment in the Southern Hemisphere of a Telescope not inferior in power to a 3-feet Reflector; and that the President (Col. Sabine), with the assistance of the following gentlemen, viz. the Earl of Rosse, Dr. Robinson, Lord Wrottesley, Professor Adams, the Astronomer Royal, J. Nasmyth, Esq., Wm. Lassell, Esq., Sir D. Brewster, and E. J. Cooper, Esq., be requested to take such steps as they shall deem most desirable to carry this resolution into effect."

The first step taken by this Committee was to communicate the resolution to the President (The Earl of Rosse) and Council of the Royal Society, who (on the 25th of November, 1852) resolved as follows:—

"That the President and Council agree with the British Association in considering it desirable to proceed without delay in obtaining the establishment of a Telescope of very great optical power for the observation of Nebulæ in a convenient locality in the Southern Hemisphere; and that a Committee be appointed to take such steps as they may deem most desirable to carry out this resolution. The Committee to consist of the President, Officers, and Council of the Royal Society, with the addition of Sir John Herschel, Sir John Lubbock, and the Dean of Ely." It was also agreed that the Committee should act conjointly with the gentlemen named in the Resolution passed by the British Association.

The joint Committee applied themselves in the first instance to a con-

sideration of the most suitable construction and dimensions of a telescope for the desired purpose. This was effected by a correspondence amongst the members of the Committee, passing through the Secretary of the Royal Society, the letters being printed for greater convenience in circulation. The proceedings of this Committee were terminated by a meeting of its members at the apartments of the Royal Society on July 5, 1853, the Earl of Rosse, President, in the Chair; when the following resolutions were passed:—

"1. That the Committee approve the proposition made by Mr. Grubb, and contained in Dr. Robinson's letter of June 30, 1853, for the construction of a *four*-foot Reflector.

"2. That application be made to Her Majesty's Government for the necessary funds.

"3. That the Presidents of the Royal Society and of the British Association, accompanied by Dr. Robinson, who was associated with the Earl of Rosse in the former application, and Mr. Hopkins, the President elect of the British Association, be a deputation to communicate with Government respecting the preceding Resolutions.

"4. That the Earl of Rosse, Dr. Robinson, Mr. Warren De la Rue, and Mr. Lassell be a Subcommittee for the purpose of superintending the progress of Mr. Grubb's undertaking."

No record appears to have been made of the subsequent steps taken by this Committee; but it is understood that the application was made to the Earl of Aberdeen, who had become First Lord of the Treasury, and that the reply received was that "no funds could be then spared as the country was engaged in the Crimean war; but that when the crisis then impending was past the matter should be taken up." Lord Aberdeen's retirement from office, and subsequent death, rendered this promise of no avail.

I must now advert to a circumstance which has exercised a most beneficial influence on the proposition for a southern telescope, and has contributed greatly to bring it to its present advanced stage. Amongst the Members of the Mathematical and Physical Section of the British Association who took part in the discussions relating to the telescope at the Belfast Meeting, there was one, Mr. William Parkinson Wilson, Professor of Mathematics in Queen's College, Belfast, who was remarked for the deep and earnest interest with which he viewed the subject. Appointed shortly afterwards to the Mathematical Chair in the University of Melbourne, Professor Wilson appears to have been impressed by the suitability of Melbourne for such a telescope, both from its latitude and climate, and from the increasing wealth and public spirit of its inhabitants manifested in the liberal support given to many scientific institutions. Melbourne enjoyed also at that time the great advantage of a Governor, Sir Henry Barkly, whose education and acquirements enabled him to appreciate the importance in such a colony of scientific cultivation. Being appointed Hon. Secretary of the Board of Visitors of the Melbourne Observatory,

then in process of organization, and with the sanction of the Governor, who was President of the Board, Professor Wilson submitted to the consideration of the Observatory Committee of the Philosophical Institute of Victoria a scheme for the establishment at Melbourne of a reflecting telescope of 4 feet aperture to carry out the objects which had been proposed by the Royal Society and British Association, as already narrated. In this proposition Professor Wilson was warmly supported by Captain Kay, R.N., F.R.S., one of the Board of Visitors, who had been for several years Superintendent of the Magnetical and Meteorological Observatory in the sister colony of Tasmania. After discussions at several Meetings, a Memorial was adopted and presented to the Chief Secretary of the Government, adverting to the favourable condition of the finances of the colony, and urging the establishment of such a telescope at Melbourne "as suited alike to render an important service to science, and to redound highly to the credit of the colony, both in Australia and in Europe."

The favourable reception of this Memorial by the Government of Victoria, and the proceedings which followed, will be best explained by the following despatch from Sir Henry Barkly to the Duke of Newcastle, then Secretary of State for the Colonies, transmitted to the Royal Society on October 10, 1862, accompanied by the expression of His Grace's assurance that "the Royal Society would do whatever may be in their power for encouraging science in the colony of Victoria."

Governor Sir H. Barkly to the Duke of Newcastle.

(Copy.)

Government Offices, Melbourne,
23rd July, 1862.

My Lord Duke,

The Board of Visitors to the Melbourne Observatory, over which I have the honour to preside, being of opinion that the project long entertained of erecting in the Southern Hemisphere a telescope of much greater optical power than that used by Sir John Herschel at the Cape of Good Hope, would be materially advanced by an expression of interest and sympathy on the part of scientific men in England, has requested me to bring the subject under Your Grace's notice, with a view to its being submitted for the Report of the Royal Society of London and the British Association for the Advancement of Science.

I have great pleasure in forwarding accordingly, with the approval of my advisers, an extract from the Board's Minutes, together with the accompanying letter from its Honorary Secretary, Professor Wilson, in which the reasons for this step are so fully set forth, and the advantages likely to arise from obtaining a powerful instrument for this purpose so clearly explained, as to leave nothing for me to add beyond earnestly soliciting Your Grace's good offices in the matter.

It will be observed that the pecuniary cooperation of the British

Government is not applied for; but I need hardly say that even the smallest donation from that quarter would much facilitate raising the necessary funds.

I avail myself of this opportunity to put Your Grace in possession of the Second Annual Report of the Board of Visitors, from which it will be found that a commencement has been made in the erection of the new Observatory, advocated in the Report previously transmitted; and I am glad to be able further to state that a sum of £4500 has since been voted by the Legislature for the completion of the requisite buildings.

Should it be possible, therefore, to add an equatorially mounted telescope, the Astronomical Branch of the Observatory will be rendered complete, and no greater expense than at present will be incurred for the Staff attached to it.

I have, &c.,

(Signed) HENRY BARKLY.

His Grace the Duke of Newcastle, K.G.,
&c. &c. &c.

Professor Wilson to Sir H. Barkly.

(Copy.)

The University, Melbourne,
16th July, 1862.

SIR,

I have the honour, by direction of the Board of Visitors to the Observatories, to forward to Your Excellency the accompanying extract from the Minutes of a Meeting held yesterday, and to express a hope that you will comply with the request contained in it.

Though entertaining no doubt of the importance of the results to be obtained by such a telescope as is recommended, or of the conspicuous and creditable position which Melbourne would consequently occupy in the eyes of all persons in Europe who take an interest in Science, the Board is desirous of obtaining an expression of opinion from scientific men in England, because it is due to those who may be asked to contribute towards its accomplishment that the importance of the object should be attested by higher scientific authority than the Board can lay claim to; because also it considers that every means should be used to obtain, so far as funds will permit, the best instrument which modern skill and recent inventions render possible; because, finally, the Board feel that, whether the cost of the instrument be defrayed wholly or partially by private contributions or a grant from the Legislature, public sympathy will be much more strongly enlisted in its favour by a statement of the interest taken in the matter in Europe, and by the approval of the Imperial Government, than by any representation which the Board can make.

I have, &c.,

(Signed) W. P. WILSON,
Secretary to the Board of Visitors.

His Excellency the Governor.

Extract from the Minutes of a Meeting of the Board of Visitors to the Observatories, held 15 *July* 1862.

"The attention of the Board having been drawn to the following circumstances—

"I. That, as long since as 1849 the facts brought to light by Lord Rosse's Telescope were judged by the Royal Society of London and the British Association for the Advancement of Science to be so important as to justify them in making an urgent appeal to the British Government for the erection, at some suitable place in south latitude, of a telescope for the examination of the multiple stars and the nebulæ of the Southern Hemisphere, having greater optical power than that used by Sir John Herschel at the Cape of Good Hope; which appeal there is little doubt would have been successful but for the Russian war and the consequent expenditure;

"II. That, since that time, Lord Rosse reports that he has discovered systematic changes in some of the most important northern nebulæ;

"III. That the interest and scientific importance of the solution of the problem of their physical structure, as well as the probability of its accomplishment, are thus greatly increased;

"IV. That some of the most important nebulæ, and those presenting the greatest variety of physical features in close proximity, can be observed only in places having a considerable southern latitude;

"V. That the geographical position and clear atmosphere of Melbourne render it peculiarly suitable for this work, and that the arrangements already made for the establishment of an Astronomical Observatory on a permanent footing offer great facilities for carrying it on;

"VI. That, independently of the especial object to which such telescope would be applied, an Astronomical Observatory cannot be considered complete without an equatorially mounted telescope of large optical power:

"It was Resolved,—

"1st. That, in the opinion of the Board, the establishment of such a telescope in Melbourne would materially promote the advancement of science.

"2nd. That, before applying to the Colonial Government for any pecuniary grant in aid of this object, His Excellency the Governor be requested to obtain, through the Secretary of State for the Colonies, an expression of opinion from scientific men in England as to the importance of the results to be expected from it, the most suitable construction of telescope for the purpose, both as to the optical part and the mounting, its probable cost, and the time requisite for its completion."

On the receipt of this communication from the Colonial Office, a correspondence ensued, passing through myself as President of the Royal Society, consisting of twenty-three letters, the writers being Mr. Lassell, Sir John Herschel, the Earl of Rosse, Dr. Robinson, Mr. Grubb, and Mr. De la Rue, which was printed for private circulation amongst the Fellows of the Royal Society. The correspondence led to and terminated in the following Report

from the President and Council addressed to the Duke of Newcastle, in reply to His Grace's communication of October 10, 1862 :—

"*Report of the President and Council of the Royal Society respecting the proposal of erecting in Melbourne a Telescope of greater optical power than any previously used in the Southern Hemisphere.*

"1. The President and Council learn with pleasure that the Board of Visitors at the Melbourne Observatory have proposed resolutions, indicating their sense of the importance of erecting at Melbourne an equatorially mounted Telescope of great optical power, and that the proposal is favourably regarded by Sir Henry Barkly, Governor of Victoria, and by His Grace the Secretary for the Colonies. In respect to the importance which the President and Council attach to such an undertaking, they need do no more than refer to the fact that in the year 1850 the Royal Society and the British Association for the Advancement of Science presented a joint Memorial to Her Majesty's Government, in which they urged the establishment of such a telescope at some suitable place in the Southern Hemisphere. The scientific objects to be attained thereby are so clearly stated in that Memorial, of which a copy is enclosed, and in the Resolutions of the Board of Visitors of the Melbourne Observatory, in July 1862, that the President and Council feel it unnecessary to do more than refer to these documents.

"2. Since the presentation of the Memorial of 1850, an equatorially mounted telescope of greater optical power than that then recommended has actually been constructed by Mr. Lassell, at his own expense, in England, and erected in Malta, where he is now occupied in making observations with it: we have now, therefore, in addition to our previous knowledge, the benefit of his experience. In referring to Mr. Lassell's Telescope, the President and Council wish it, however, to be understood that they do not conceive that it should necessarily be copied in all respects, and that for the present they think it best to leave the details of construction in many respects open to further consideration.

"3. When the subject was previously under consideration, letters were written to some of the most eminent practical astronomers of Great Britain and Ireland, requesting them to state their opinions as to the best mode of construction; and a correspondence ensued, of which a printed copy is sent herewith. After receiving the communication from the Colonial Office of the 10th of last October, the President wrote to the four gentlemen who were appointed as a Committee on the former occasion to superintend the construction of the instrument (in case the Government should accede to the request), and also to Sir John Herschel, enclosing a copy of the former correspondence, and asking whether their views had in any way changed in the interval. The answers received from each have been circulated among the others, as was done on the former occasion, and have in most cases elicited additional remarks.

"4. Availing themselves of the information thus so kindly afforded

them, the President and Council have to recommend as follows regarding the construction of the instrument contemplated.

"(*a*) That the telescope be a reflector, with an aperture of not less than four feet. This is essential, as no refractor would have the power required.

"(*b*) That the large mirror be of speculum-metal. Such mirrors can be constructed with certainty of success, and at a cost which can be foretold; whereas the recently introduced plan of glass silvered by a chemical process has not yet been sufficiently tried on so large a scale as that contemplated.

"(*c*) That the tube be constructed of open work, and of metal. Lord Rosse has recently changed the tube of his three-foot altazimuth from a close to an open or skeleton one, and it is understood that he intends doing the same with his great telescope. Mr. Lassell's tube is also an open one, which his experience leads him decidedly to prefer.

"(*d*) The telescope should be furnished with a clock-movement in right ascension.

"(*e*) Apparatus for repolishing the speculum should be provided.

"(*f*) With respect to the form of reflector to be adopted, some difference of opinion exists, as the Newtonian and Cassegrainian have each some advantages not possessed by the other. On this point further correspondence appears desirable; but as the main features of the scheme are the same in both cases, there does not appear to be any occasion to wait till this point shall have been finally decided.

"5. With respect to the cost, something must depend on the solidity of the construction and the perfection of the workmanship; but if it be assumed that the workmanship shall be of the best description, and the instrument furnished, as seems desirable, with polishing apparatus, and a second speculum for using while the other is being polished, it is probable that the cost will not fall much short of £5000.

"6. It is estimated that the construction of the instrument will occupy about eighteen months.

"7. It seems highly desirable that the future Observer should come to England during a part at least of the time occupied in the construction of the instrument, in order that he may become thoroughly acquainted with all its details, and especially with the mode of repolishing; and also that he may personally acquaint himself with the working arrangements followed at the Observatories of the Earl of Rosse and Mr. Lassell, who have expressed their willingness to afford him every facility."

This Report, accompanied by several copies of the Correspondence adverted to, was transmitted in due course to Melbourne.

In 1863 Mr. Lassell made the most liberal offer of freely presenting for the observations at Melbourne his own 4-foot reflector, with which he had been carrying on a series of observations at Malta, as soon as that series should be completed, or in the course of a year or two. The construction of this telescope had been largely considered and discussed in the correspondence already adverted to. On Mr. Lassell's munificent offer being

transmitted to Melbourne, the authorities there were at first disposed to embrace it; but subsequently, on further consideration and correspondence, they determined to revert to the original plan, of a telescope to be constructed by Mr. Grubb expressly to meet in the most perfect attainable manner all the special requirements of the case. This plan is described in a letter addressed to Dr. Robinson on the 3rd of December, 1862, being the thirteenth letter in the printed Correspondence referred to. It seems scarcely possible to doubt the wisdom, in every point of view, of the decision thus arrived at. The alterations which would have been required in Mr. Lassell's telescope would have demanded a large proportion of the time and the expense needed for the construction of the new one; and the result would have been that Europe would have lost all the services which Mr. Lassell's telescope may still perform—while Australia would have had a much less perfect instrument, for the especial purposes in view, than it will now possess.

In April 1864 a proposition for a grant of £5000, to cover the expense of constructing a telescope, was submitted to the Colonial Legislature by one of its members, Mr. Alexander John Smith, also a Member of the Board of Visitors of the Observatory, who, previously to his residence in Victoria, had been one of that band of highly-trained naval observers who, under the command of Sir J. C. Ross, had accomplished, between the years 1839 and 1843, the Magnetic Survey of the Antarctic regions, and had subsequently become one of the officers employed with Capt. Kay in the Magnetical and Meteorological Observatory at Hobarton. This proposition was successful; and the notification received from Professor Wilson is printed in the text of this Address, p. 483.

Note B.

The number of hourly tabulations from the photographic traces of the bifilar magnetometer at Kew, between January 1, 1858, and December 31, 1864, is 60,491: of these, the number in which the amount of disturbance from the normal of the same year, month, and hour equalled or exceeded 0·150 division of the scale, or ·0015 of the total horizontal force at Kew, was 5932, being about one in ten of the whole number of tabulated hourly values. The aggregate value of the 5932 disturbed observations in parts of the bifilar scale, of which 1 inch equals ·01 of the whole horizontal force, was as follows:—

Year ending December 31,		1858	267·893	inches.
,,	,,	1859	369·286	,,
,,	,,	1860	270·349	,,
,,	,,	1861	206·748	,,
,,	,,	1862	183·645	,,
,,	,,	1863	114·642	,,
,,	,,	1864	114·725	,,

The *mean* annual value in the seven years is 218·184 inches; and the ratios of disturbance, in each of the seven years, to the mean annual value are as follows:—

Year ending December 31,		1858	1·23
,,	,,	1859	1·69
,,	,,	1860	1·24
,,	,,	1861	0·95
,,	,,	1862	0·84
,,	,,	1863	0·53
,,	,,	1864	0·53

NOTE C.

Mean Annual Values of the Magnetic Inclination at Toronto deduced from the Monthly Determinations; reprinted from Table LIII. (p. 93) of the 'Abstracts of Observations made at the Magnetic Observatory at Toronto,' published by its Director, G. T. Kingston, Esq. The years 1863 and 1864 are added from the Numbers of the 'Canadian Journal of Science.'

"The monthly determinations were commonly made on three consecutive days, as nearly as possible about the middle of the month. One determination was usually made each day between noon and 1 P.M. The monthly and annual means were derived directly from the observations."

Years.	1853.	1854.	1855.	1856.	1857.	1858.	1859.	1860.	1861.	1862.	1863.	1864.
Yearly Means. 75°+	22·17	22·96	23·54	24·06	24·32	24·44	24·98	24·55	23·75	23·19	21·47	20·93

On the motion of Mr. Warren De la Rue, seconded by Colonel Yorke, 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 Statutes relating to the election of Council and Officers having been read, and Mr. De la Rue and Mr. Merrifield having been, with the consent of the Society, nominated Scrutators, the votes of the Fellows present were collected, and the following were declared duly elected as Council and Officers for the ensuing year:—

President.—Lieut.-General Edward Sabine, R.A., D.C.L., LL.D.

Treasurer.—William Allen Miller, M.D., LL.D.

Secretaries.—William Sharpey, M.D., LL.D.; George Gabriel Stokes, Esq., M.A., D.C.L.

Foreign Secretary.—Professor William Hallows Miller, M.A.

Other Members of the Council.—John Frederic Bateman, Esq.; Lionel Smith Beale, Esq., M.B.; William Bowman, Esq.; Commander F. J. Owen Evans, R.N.; Edward Frankland, Esq., Ph.D.; Francis Galton, Esq; John Peter Gassiot, Esq.; John Edward Gray, Esq., Ph.D.; Thomas Archer Hirst, Esq., Ph.D.; Sir Henry Holland, Bart., M.D., D.C.L.; William Odling, Esq., M.B.; Sir John Rennie, Knt.; Prof. Warington W. Smyth; William Spottiswoode, Esq., M.A.; Paul E. Count de Strzlecki, C.B., D.C.L.; Vice-Chancellor Sir W. P. Wood, D.C.L.

The thanks of the Society were voted to the Scrutators.

Receipts and Payments of the Royal Society between December 1, 1864, *and November* 30, 1865.

	£	s.	d.
Balance at Bank, and on hand	683	14	1
Annual Subscriptions and Compositions	1771	16	0
Rents	249	8	5
Dividends on Stock	963	10	11
Ditto, Ditto, Trust Funds	281	17	6
Ditto, Ditto, Stevenson Bequest	512	11	10
Sale of Transactions, Proceedings, &c.	308	16	9
Chemical Society, Proceedings, 1863–64	50	0	0
Tea Expenses and Gas, repaid	43	6	0
Prof. Cayley, repaid to Donation Fund	15	0	0
Parcel Charges recovered	1	18	7
	£4882	0	1

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

Estate at Mablethorpe, Lincolnshire (55 A. 2 R. 2 P.), £126 0*s.* 0*d.* per annum.
Estate at Acton, Middlesex (34 A. 3 R. 11 P.), £110 0*s.* 0*d.* per annum.
Fee farm rent in Sussex, £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.
£14,000 Reduced 3 per Cent. Annuities.
£28,969 15*s.* 7*d.* Consolidated Bank Annuities.
£513 9*s.* 8*d.* New 2½ per Cent. Stock.

	£	s.	d.
Balance due to Bankers	135	7	10
	£5017	7	11

	£	s.	d.
Salaries, Wages, and Pension	1023	17	0
£1000 Consolidated Bank Annuities, bought at 90⅜	905	0	0
The Scientific Catalogue	235	9	10
Books for the Library and Binding	362	7	10
Printing Transactions and Proceedings, Paper, Binding, Engraving, and Lithography	1711	10	9
New Bookcases, Painting, and Repairs	127	3	1
Coal and Lighting	109	1	2
Tea Expenses	46	15	2
Fire Insurance	42	1	6
Shipping Expenses	4	13	11
Taxes	15	1	3
Law Expenses	47	7	10
Stationery	10	6	6
Miscellaneous Expenses	48	0	3
Postage, Parcels, and Petty Charges	33	12	2
Advertising	14	10	6
Subscription:—Mablethorpe Schools	2	2	0
Rumford Fund	138 5 10		
Donation Fund	75 0 0		
Wintringham Fund	35 0 6		
Copley Medal Fund	4 15 0	259	19 9
Prof. Roscoe, Bakerian Lecture	4 0 0		
Dr. Beale, Fairchild Lecture	2 18 5		
Rev. T. S. Evans, Croonian Lecture	2	18	5
	5001	18	11
Balance of Catalogue Account	11	17	3
,, Petty Cash Account	3	11	9
	£5017	7	11

WILLIAM ALLEN MILLER,
Treasurer.

Scientific Relief Fund.

Investments up to July 1865, New 3 per Cent. Annuities £6052 17 8

£6052 17 8

Dr. *Cr.*

	£	s.	d.		£	s.	d.
To Balance, Subscriptions and Dividends	1129	0	8	By Grants	275	0	0
				Purchase of Stock	672	10	0
				Balance	181	10	8
	£1129	0	8		£1129	0	8

Statement of Income and Expenditure (apart from Trust Funds) during the Year ending November 30, 1865.

	£	s.	d.		£	s.	d.
Annual Subscriptions	1131	16	0	Salaries, Wages, and Pension	1023	17	0
Admission Fees	180	0	0	The Scientific Catalogue	235	9	10
Compositions	460	0	0	Books for the Library	283	7	10
Rents	249	8	5	Binding ditto	79	0	0
Dividends on Stock (exclusive of Trust Funds)	963	10	11	Printing Transactions, Part III. 1864, and Part I. 1865 ..... 497 6 5			
,, on Stevenson Bequest	512	11	10	Ditto Proceedings, Nos. 68–77 ..... 305 4 1			
Sale of Transactions, Proceedings, &c.	308	16	9	Ditto Miscellaneous 65 14 6	1711	10	9
Chemical Society, for Proceedings, 1863–64	50	0	0	Paper for Transactions and Proceedings ... 347 16 6			
Chemical Society, Tea Expenses £15 11 8				Binding and Stitching ditto 105 9 5			
Linnean Society, Tea Expenses 15 11 8	31	3	4	Engraving and Lithography 389 19 10			
Geographical Society, Gas at Evening Meetings 8 4 8				New Bookcases, Painting, and Repairs	127	3	1
Cambridge Local Examination Committee, Gas 3 18 0	12	2	8	Miscellaneous Expenses	48	0	3
Parcel Charges recovered	1	18	7	Coal and Lighting	109	1	2
				Tea Expenses	46	15	2
Income available for the Year ending Nov. 30, 1865	3901	8	6	Fire Insurance	42	1	6
Expenditure in the Year ending Nov. 30, 1865	3834	0	9	Subscription:—Mablethorpe Schools	2	2	0
				Shipping Expenses	4	13	11
				Taxes	15	1	3
				Law Expenses	47	7	10
				Stationery	10	6	6
				Advertising	14	10	6
Excess of Income over Expenditure in the Year ending Nov. 30, 1865	£67	7	9	Postage, Parcels, and Petty Charges	33	12	2
					£3834	0	9

WILLIAM ALLEN MILLER,
Treasurer.

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

	Patron and Royal.	Foreign.	Having compounded.	Paying £2 12*s.* annually.	Paying £4 annually.	Total.
November 30, 1864.	6	49	320	3	276	654
Since elected	+1	.....	+9	.....	+10	+20
Since deceased	−1	−2	−20	.....	−10	−33
Since withdrawn ..	.....	.....	.....	.....	−1	−1
Since defaulter	.....	.....	.....	.....	−1	−1
November 30, 1865.	6	47	309	3	274	639

Further Correspondence between the Board of Trade and the Royal Society, in reference to the Magnetism of Ships, and the Meteorological Department *.

Mr. Farrer to General Sabine.

"Board of Trade, Whitehall, 25th July, 1865.

"Sir,—I am directed by the Lords of the Committee of Privy Council for Trade to acknowledge the receipt of your letter of the 25th May, and its inclosed Memorandum, calling attention to the subject of the adjustment of compasses in iron vessels.

"The Memorandum states that the subject of the deviation of compasses is one which has hitherto been regarded as too intricate and obscure to be made the subject of practical rules for seafaring men, but that recent experience has placed the science on a sound basis, and has made it possible to frame rules which there will be no practical difficulty in applying.

"The Memorandum further intimates what those rules should be with respect to the placing and adjustment of compasses, and suggests that measures should be taken by the Board of Trade to enforce their observance. It also suggests that steps should be taken to compel Merchant Officers to become acquainted with them; and finally recommends that for the accomplishment of these purposes an Officer should be appointed, whose duty it should be, in communication with the Compass Department of the Admiralty, to aid the Board of Trade in carrying it into effect.

* Published by order of the Council.