

**REPORT**

OF THE



**EIGHTEENTH MEETING**

OF THE

**BRITISH ASSOCIATION**

FOR THE

**ADVANCEMENT OF SCIENCE;**

HELD AT SWANSEA IN AUGUST 1848.

**LONDON:**

**JOHN MURRAY, ALBEMARLE STREET.**

1849.

## CORRESPONDING MEMBERS.

Professor Agassiz, Neufchatel.	M. Kupffer, St. Petersburg.
M. Arago, Paris.	Dr. Langberg, Christiania.
Dr. A. D. Bache, Philadelphia.	M. Leverrier, Paris.
Professor H. von Boguslawski, Breslau.	Baron de Selys-Longchamps, Liège.
Monsieur Boutigny (d'Évreux), Paris.	Dr. Lamont, Munich.
Professor Brachmann, Moscow.	Baron von Liebig, Giessen.
Chevalier Bunsen.	Professor Link, Berlin.
Charles Buonaparte, Prince of Canino.	Professor Matteucci, Pisa.
M. De la Rive, Geneva.	Professor von Middendorff, St. Petersburg.
Professor Dove, Berlin.	Professor Nillson of Sweden.
Professor Dumas, Paris.	Dr. Ørsted, Copenhagen.
Dr. J. Milne-Edwards of Paris.	Chevalier Plana, Turin.
Professor Ehrenberg, Berlin.	M. Quetelet, Brussels.
Dr. Eisenlohr, Carlsruhe.	Herr Plücker, Bonn.
Professor Encke, Berlin.	Professor C. Ritter, Berlin.
Dr. A. Erman, Berlin.	Professor H. D. Rogers, Philadelphia.
Professor Esmark, Christiania.	Professor H. Rose, Berlin.
Professor Forchhammer, Copenhagen.	Professor Schumacher, Altona.
M. Frisiani, Milan.	Baron Senftenberg, Bohemia.
Professor Henry, Princeton, United States.	Dr. Siljeström, Stockholm.
Baron Alexander von Humboldt, Berlin.	M. Struvè of St. Petersburg.
M. Jacobi, St. Petersburg.	Dr. Svanberg, Stockholm.
Professor Jacobi, Königsberg.	Dr. Van der Höven, Leyden.
Professor Kreil, Prague.	Baron Sartorius von Waltershausen, Gotha.
	Professor Wartmann, Lausanne.

REPORT OF THE PROCEEDINGS OF THE COUNCIL IN 1847-48, PRESENTED TO THE  
GENERAL COMMITTEE AT SWANSEA, WEDNESDAY, AUGUST 9, 1848.

*Report of the Council to the General Committee.*

1. With reference to the subjects on which the Council was requested by the General Committee, assembled at Oxford, to make applications to Her Majesty's Government and to the Court of Directors of the East India Company, the Council has to report, that similar resolutions to those of the General Committee having been passed by the Council of the Royal Society, applications in accordance with them were made by the Presidents of that Society and of the British Association, acting conjointly, and were favourably received. On the subject of the first resolution, the Council understand from Lord Auckland's reply, that the Board of Admiralty will appropriate a suitable vessel for the purpose of an investigation into the Phænomena of the Tides, as soon as the most advisable plan for her employment shall have been determined upon, and proper instructions suggested. With respect to the second resolution, the Court of Directors of the East India Company have issued orders for carrying into regular and continued operation the tide observations on the coasts of Western India and Scinde;—and with respect to the third resolution, the Court of Directors have placed the standard bar and scale of the Indian arc of the meridian at the disposal of M. Struvè, and have permitted him to take it with him to Russia, in order that it may be there com-

pared with the similar instruments which have been employed in the measurements of the Russian arc of the meridian.

2. The Council have been informed, that a deputation from the Philosophical Society of Birmingham has been appointed to present, at this Meeting, an invitation from that Society and from other public bodies at Birmingham, to the British Association, to hold the Meeting of 1849 in that town.

3. The Council have received from Mr. Phillips, Assistant General Secretary, a communication entitled "Reasons for thinking that the Annual Meetings of the British Association ought not to be restricted to places which present formal invitations and guarantees of expenses." Considering the importance of the subject, and the respect due to the opinions of so experienced and zealous a friend of the Association, the Council have deemed it desirable that Mr. Phillips's communication should be brought to the notice of the General Committee on the occasion of presenting this Report: but having been apprised that an invitation is to be brought forward at Swansea to hold the Meeting of 1849 at Birmingham, and regarding this invitation as likely to be very favourably received, it has not appeared to the Council desirable to take any other present steps in reference to the subject of Mr. Phillips's communication, than that of bringing the communication itself to the notice of the General Committee. (See page xxi).

4. The Council have added the following names to the list of Corresponding Members of the British Association:—

M. Struvè of St. Petersburg.  
 M. Leverrier of Paris.  
 Charles Buonaparte, Prince of Canino.  
 The Chevalier Bunsen.  
 Professor Nillson of Sweden.  
 Professor Esmark of Christiania.  
 Dr. Van der Höven of Leyden.  
 Dr. J. Milne-Edwards of Paris.

5. The Council have deemed it desirable to take into serious consideration the expediency of maintaining for a longer period the establishment at Kew; for this purpose they reappointed the Committee whose former report on the same subject was submitted to the General Committee at Southampton in 1846, and they now submit to the General Committee a second report from the same Committee. The Council have also to express their concurrence in the opinions contained in that report, with respect to the services which have been rendered to science by that institution, even on the limited scale on which alone it has been in the power of the British Association to maintain it; and to the probability that ere long the interests of science and the requirements of the public service will call for a Government establishment, having for its purpose some of the important objects originally contemplated by the observatory at Kew. The Council also concur in the opinion expressed by the Committee, of the expediency of deferring for the present a memorial to Her Majesty's Government on the subject.

*Report of the Kew Observatory Committee.*

The Committee appointed to consider the subject of the Kew Observatory having obtained from Mr. Ronalds a report on the actual state of the building, the instruments and other property of the Association therein deposited, as well as respecting the observations and experiments made there up to the present time, are enabled to state to the Council as respects the former, that

they are in a satisfactory condition, the building having undergone recently (on the representation by Mr. Ronalds to the Commissioners of Woods and Forests, in September 1847, of their necessity) such *external* repairs as suffice for its preservation, and that the instruments, such as are actually in use, are in good order and accomplishing the purposes of observation for which they have been constructed. An inventory of them has been furnished to the Committee by Mr. Ronalds, who is at present engaged in making out a complete catalogue of all the property of the Association on the premises.

In reporting on the scientific objects accomplished since their last report in 1846, they consider that they cannot do better than to extract such portions of Mr. Ronalds's reports above mentioned as bear upon this head.

“The journal of ordinary observations has proceeded as usual; fourteen observations per diem have been pretty constantly set down of electric observations.

“In the course of August 1846, many of the *magnetic* photographs were submitted to a rigid comparison with the corrected readings of the Greenwich magnet, and the result was officially declared to be ‘highly satisfactory.’

“In the same month Dr. Banks brought an experimental specimen of his registering anemometer to Kew, and tried it at the north-eastern angle of the electric observatory.

“In September the third volume of Observations and Experiments was completed and carried to the Southampton Meeting of the British Association.

“In December 1846, having by experience (since the beginning of August 1845) found that my preliminary experiments, made upon a thermometer, a barometer, and an electrometer, each placed in the *same camera* or microscope *alternately*, fully warranted the cost of constructing apparatus of a durable and convenient character for each instrument, I began to make (at Chiswick) the photo-registering barometer, now at Kew, and spent several months in its completion. It is furnished with a compensating apparatus (on the principle of the gridiron-pendulum), whereby the necessity of a correction for temperature is certainly to a great extent, if not completely, avoided; it has one of Newman's standard tubes, and the image of the surface of the mercury itself is employed totally unencumbered by any ball, plug, float, or machinery of any kind; the mercury is therefore as free to act in this as in any standard barometer. And it can be at any time used without the compensating apparatus, if that should be deemed objectionable. The same time-piece moves this and the magnetic apparatus.

“In May 1847, the magnetic apparatus was improved by the substitution of new lenses by Ross in lieu of Voightlander's. This enlarged the scale of declination.

“In January 1847, a complete electrical apparatus, exactly similar to mine in the dome at Kew for ordinary observations, was begun by Mr. Newman, by order of the East India Company, for the Bombay Observatory, and afterwards sent. Drawings were lent, instructions given, and electrometers made to correspond exactly with the Kew instruments.

“In November 1846, drawings relative to Mr. Scott Russell's experiments on the forms of vessels arrived at Kew, and I afterwards tried hard to get possession of the models themselves (in pursuance of a resolution of the Association), but without success.

“In May 1847, Mr. Hunt's actinometer arrived at Kew.

“In June 1847, the fourth volume of observations was completed and carried to the Oxford Meeting.

“At this meeting some conversation, &c. occurred about establishing an

electro-meteorological and magnetical observatory at Alten, in Finmark, and proposing to furnish some electrical apparatus from Kew and of my own, but nothing has been achieved in this way.

"In September 1847, repairs of the building becoming more urgent, I addressed a third application to the Woods and Forests through Mr. Phillips, and a new estimate for complete external and internal repairs was made, amounting to £271. The Commissioners, Mr. Milne, Mr. Burton, and Mr. Phillips, then visited the Observatory, examined it, and the apparatus, &c., and very soon afterwards all such repairs were executed as were fully sufficient to render it at least *wind-* and *water-tight*, which rendered a great service to the magnet.

"In November 1847, the magnetical apparatus was improved by the addition of a second condensing lens, placed beyond and very near to the index, and by an adjustment for the height of the lamp.

"At about the same time the barometric apparatus was improved by like means.

"In December 1847, the apparatus for registering photographically the electricity of the atmosphere now established at the south window of the south upper apartment (in pursuance of the experiments made in July and August 1845 *et seq.*) was in course of construction, and was completed in February 1848.

"I took much pains in the course of several months prior and subsequent to this time to arrange a system whereby photographic papers might be put into the microscopes (or camera) daily, and sent to Mr. Henneman's establishment, in Regent-street, to be there fixed and calotyped, and the positive impressions thence distributed to any meteorologists whom the British Association might think proper to appoint to receive them. These endeavours have been zealously promoted by Mr. Malone, and will become, I trust, useful.

"We now arrive at a circumstance which I (of course) cannot but esteem of importance. In Mr. Glaisher's remarks on the weather during the quarter ending December 31, 1847, for the Registrar-General's Report (at p. 2), he says, in reference to the Greenwich electrical apparatus,—'It is a fact well-worthy of notice, that from the beginning of this quarter till the 20th of December, the electricity of the atmosphere was almost always in a neutral state, so that no signs of electricity whatever were shown for several days together, by any of the electrical instruments,' &c. At this notice I sent to Greenwich an abstract from our journal of the maxima and minima of the two-hourly charges of the conductor during the same period, by which it was seen that the electricity of the atmosphere at Kew was *never* in a neutral state then, and I found that so low a charge was never observed during that time as has been observed in other periods. These circumstances were candidly stated in the next report. It was thought that this discrepancy between the two conductors, &c. might arise, wholly or in part, from the great length of the conducting wire, which extends from the top of the mast at Greenwich to the magnetic observatory, where the electrometers are placed. Both theory and experiment fully confirm my belief that this was the *chief* cause of the difference, and is the cause of a want of constancy in signs at Greenwich. (A few experiments upon my own conductor with a long wire have lately confirmed the fact still more.)"

On this report the Committee have to remark with satisfaction, as on scientific objects usefully and availably carried out,—1st. On the photogra-

phic self-registering processes which Mr. Ronalds has applied to the several objects of magnetic and meteorological observation—processes which (without reference to, or comparison with, what may have been doing simultaneously elsewhere or by others) appear to the Committee of much value and importance to the future progress of meteorological and magnetic inquiry; and, 2ndly, on the valuable series of electrical observations which have now been made during five years, and during the last three and a half at 2-hourly intervals day and night uninterruptedly, with observations also at sunrise and sunset. As these observations afford what it is presumed are not to be found at all, or at all events not for so long and consecutive a series, distinct numerical values of the electrical tension comparable at least *inter se*, the Committee have considered that they ought to undergo regular and complete reduction and discussion, with a view to eliciting from them the laws of the phænomena; and on this subject they have conferred with Mr. Birt, who has submitted to them a plan of reduction which they regard as satisfactory, and which he is willing to execute on a grant of £50 being made to him for that purpose; a sum which they consider not excessive, and which they strongly recommend the Council to propose to the general body at the ensuing meeting.

On the subject of the comparability of these results with those obtained, or to be hereafter obtained at Greenwich or elsewhere, it certainly would be desirable that some distinct series of comparative trials should be made; and the Committee would have considered the execution of such a series an important practical object to be accomplished during the next year of the continuance of the observatory, but for considerations which it is now their duty to state.

The question as to the expediency of continuing the present expenditure of the establishment has occupied the anxious attention of the Committee, conceiving that the Council, by making mention of it in their resolution of April 14, is desirous of having their opinion on this head. In endeavouring to form a sound one, they have taken into consideration the state of the funds of the Association, and also the circumstances of the establishment itself, which they are of opinion cannot for the future, or even for a single additional year, be carried on in a manner satisfactory to the Association *on so low a scale* of expenditure as that which, by a fortunate conjunction of personal circumstances eminently favourable, has hitherto been found practicable; and that in fact, to carry out fully some of the most important objects which have all along been contemplated in its occupation by the Association, a very considerable *increase* of outlay would, in their opinion, be annually necessary. Such increase however, in the actual state of the funds of the Body, they are by no means prepared to recommend—since they perceive that even the present expenditure (could they guarantee that it shall not be exceeded) must prove a drain upon those funds for which the amount of scientific advantage to be expected from it on a scale of action so limited, will not be held an adequate return. Entertaining this view of the matter, and conceiving it equally inexpedient either to attempt to raise by private subscription an annual amount adequate to the object, or to apply to Government for aid (although they consider it by no means impossible that ere long the exigencies of the public service may require an establishment, having for its object some of the most important of those contemplated in this), they see no course open but to recommend its discontinuance from the earliest period at which it shall be found practicable, leaving it to the

Committee to ascertain (should the Council adopt this view) the most fitting mode of procedure for resigning it into the hands of Government, who have so liberally allowed the Association its temporary occupation.

Signed on the part of the Committee,  
J. F. W. HERSCHEL.

*Reasons for thinking that the Annual Meetings of the British Association ought not to be restricted to places which present formal invitations and guarantees of expenses.*

1. "By the rules of the Association, the General Committee has the duty of appointing the place, time and officers of the annual Meetings.

2. "By custom, this power has been limited to *places* which present invitations, to *times* suitable for those places, and to *officers* more or less indicated by local circumstances.

3. "The practice of obeying local invitations has been productive of good and evil: good by the spontaneous awakening of many important places to scientific activity; evil by the introduction of elements of display, temporary expedients, and unnecessary expense. These have somewhat impaired the efficiency of the Meetings, by withdrawing attention and consuming time which could ill be spared from the essential business of one scientific week.

4. "It is the opinion of the writer, that the balance of good and evil in this practice will become less and less favourable to the Association as time goes on; that by its operation the Meetings of the Association are likely to be made more dependent on commercial and other extrinsic considerations than on advantages of locality; that places in the highest degree desirable to be visited may not present invitations and guarantees; that invitations which it may be difficult to refuse may be pressed from places quite unsuitable for the Meeting; and that, finally, the Association may be reduced, not seldom, to the necessity of suspending its Meetings, or of seeing them poorly attended by unwilling members, unfruitful of knowledge and unproductive of money.

5. "He thinks the proper way to prevent these misfortunes is to declare that in making arrangements for the future Meetings, the General Committee will be guided by general considerations, and will regard as only one of the elements for its decision, the circumstance of special invitations from particular localities.

6. "And he thinks that this declaration should not be delayed beyond the Swansea Meeting, where we may speak from the vantage-ground of a very unanimous invitation from a place of singular attractions.

"He farther remarks that this plan will throw no discredit on invitations, which, as part of the elements for fixing on the places of Meeting, will still be acceptable and influential. Places presenting them, will still have the advantage, and often the preference, which such proof of scientific activity may deserve. The invitations will perhaps be as numerous after, as they have been before the change.

"There is no change necessary in respect of the previous arrangements, which must still include inspection of the localities, consultation with residents, &c. before the General Committee can be called on to decide.

"He will now say a few words on the financial part of this question.

"The system upon which the Association has been worked of late years, produces an expenditure of nearly £750 for the local expenses of rooms, printing, clerks and messengers, &c. at each Meeting. Of this £500 has been raised by local contributions, and the remainder paid by the British