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LORD WROTTESLEY, F.R.S., PIONEER STATESMAN OF SCIENCE

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[*Plates 18 and 19*]

JOHN, LORD WROTTESLEY, was born on 5 August 1798 and died a century ago on 27 October 1867. In the course of an active life he was elected to the highest scientific office, serving as President of the Royal Society from 1854 to 1858; he succeeded the Prince Consort as President of the British Association for the Advancement of Science for the Oxford meeting of 1860, now celebrated as the occasion of Huxley's clash with Bishop Wilberforce over the theory of evolution; in the more specialized fields of scientific endeavour he was, in turn, original member, Secretary and President of the Royal Astronomical Society.

Today, Wrottesley's name is virtually forgotten and his work remains in obscurity. No doubt the reasons for this neglect are understandable: he made no contributions to the conceptual structure of science and his experimental work in astronomy, whilst painstaking, was otherwise undistinguished. His successor as President of the Royal Society, Sir Benjamin Brodie, prescribed the condition for scientific immortality in his inaugural address in 1858: 'It is, indeed, the interest of every one who is ambitious that his name as a discoverer should be transmitted to posterity, that his works should have a place in the *Philosophical Transactions* . . .' (1). In a strict sense, Wrottesley satisfied this condition only to the extent of one paper in 1851, recording the results of his observations on the positions and distances of certain double stars (2). Other papers were published in the *Memoirs* and the *Monthly Notices of the Royal Astronomical Society*; a further contribution on double stars appeared in the *Proceedings of the Royal Society* for 1859 (3). His substantial achievements, however, lay in a different sphere, that of inducing his fellow-countrymen 'to regard with favour and respect, to cherish and foster, to appreciate and reward the labours of the cultivators of Science' (4); he was a pioneer investigator of the conditions under which scientific activity might best flourish, and, in particular, of 'the Relations of Science to the supreme authorities in the State . . .' (5).

At the present time when the problems of constructing a national policy

Plate 18

LORD WROTTESLEY, F.R.S. (1798–1867)
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[*Facing page 230*

for science are a major concern, it is appropriate to look again at Wrottesley's achievement. Few, if any, of the scientists of his day saw more clearly than he the consequences of the transition from 'little science' to 'big science'. He contributed to a revision of the institutional structure of the scientific community and to the growth of science as a profession. Some fifteen years before Colonel Strange and others began to press for state intervention to secure the progress of science, Wrottesley was seeking the views of his fellow scientists on the question 'Whether it might be possible to improve the position of science or its cultivators in this country by any measures to be adopted by Government or Parliament' (6). For sixteen years he served as Chairman and most active member of the Parliamentary Committee of the British Association for the Advancement of Science; in this capacity, and as President of the Royal Society, he prompted the scientists of his day to examine the relations of science to government, and in particular the idea of a new Board specially constituted to advise the nation on scientific matters and to ensure that all measures necessary for the advance of science were undertaken (7). Important amongst these measures was the introduction of science as a major element in the curricula of schools and universities; Wrottesley strongly urged the expediency of this reform (8), and the Parliamentary Committee was a pressure group of some significance in the field of English education. National considerations did not limit his vision of the scientific enterprise, however; he was a persuasive advocate of international scientific co-operation, and played a major part in securing representation by Britain at the Brussels International Maritime Meteorological Conference of 1853, one of the earliest international gatherings of scientists (9). By any standards, he emerges as a far-sighted and sagacious administrator of science. The contribution to scientific affairs of his younger contemporaries such as Grove, Playfair and Strange has been recognized, albeit belatedly (10), but Wrottesley's pioneer work remains largely overlooked.

As a boy, and like other members of his family before him, Wrottesley attended Westminster, the school from which his father had been expelled as one of the ringleaders of a rebellion during the headship of the easy-natured Samuel Smith (11). Wrottesley's own years there, 1810 to 1814, during the régime of William Carey, could have done little to foster a spirit of inquiry about the physical world; pugilistic rather than scientific skill appears to have been the order of the day (12). As for family influences, both his father and grandfather had enjoyed distinguished military careers, later representing Staffordshire and other constituencies in the House of Commons: there was little here to suggest the scientific eminence that lay ahead (13).

It was presumably at Oxford that Wrottesley began to cultivate those interests which were to remain of central importance for the remainder of his life. From the time of Queen Elizabeth there had been close relations between Westminster and Christ Church (14) and Wrottesley was fortunate in entering the college at a time when its reputation stood high, in no small part due to the influence of Dean Cyril Jackson. He matriculated in May 1816, at the age of 17, graduating in 1819 with a first-class in mathematics (15).

In 1807 important changes had been effected in the schemes of study and examination at Oxford. The examination for the Master's degree had been abolished but, more importantly, a School of Mathematics and Physics, separated from the School of Literae Humaniores, had been established (16): the examinations covered not only Pure but also 'Mixed' Mathematics, which included Mechanics, Optics, Hydrostatics and Astronomy (17). No doubt Wrottesley attended lectures given by the newly appointed Reader in Experimental Philosophy, Stephen P. Rigaud, F.R.S. (1774-1839), a protégé of Dean Jackson and son of the astronomer at the Royal Observatory, Kew. Rigaud was also Savilian Professor of Geometry, eventually succeeding Abram Robertson in 1827 as Radcliffe Observer and Savilian Professor of Astronomy (18).

Speaking of his Oxford years on his return to the city for the 1860 meeting of the British Association, Wrottesley acknowledged a particular debt to John Kidd, Professor of Chemistry, who was his Christ Church tutor (19).

By the time he left Oxford, and despite the almost total inactivity of the Radcliffe Observatory, Wrottesley had both a deep interest and an outstanding competence in astronomical matters; in 1820 he was one of the original members of the Royal Astronomical Society (13). Although he entered Lincoln's Inn in 1819, being called to the Bar in 1823 and practising for a time as an equity lawyer, it is clear that his scientific work continued. His knowledge of astronomy and navigation enabled him to make numerous contributions to the publications of the Society for the Diffusion of Useful Knowledge (20). In 1829 he commenced the erection of an observatory at Blackheath and began observations in the spring of 1831, assisted by John Hartnup, later Assistant Secretary to the Royal Astronomical Society and subsequently Astronomer at the Observatory at Liverpool. The publication of the star catalogue of the Astronomical Society in 1827 had suggested the need for re-observing the stars listed, in order to throw light on the question of their proper motions. Wrottesley selected 1318 stars from the catalogue, choosing those of the sixth and seventh magnitudes, and planned to observe each star at least ten times, the right ascension being compared with the

corresponding values in the Society's catalogue. The results of this extensive programme, embodying over 12 000 observations, were read before the Astronomical Society in 1836, and later published in the *Memoirs* (21). The Council awarded its Gold Medal to Wrottesley in February 1839, on which occasion the President, Mr F. Baily, praised the new catalogue as a work of the utmost reliability and first-rate importance. A supplementary catalogue of the right ascensions of a further 55 stars was to follow (22).

From 1831 to 1833, in collaboration with A. De Morgan, Wrottesley had served as Secretary of the Royal Astronomical Society; the spring of 1841 saw his election to the presidency, in succession to Sir John Herschel. A month later, on 16 March, his father died and Wrottesley acceded to the title. On 29 April, came his election into the Fellowship of the Royal Society.

Lord Wrottesley now transferred his observatory to his family residence, Wrottesley Hall, near Wolverhampton. A description of the observatory and its new equatorially-mounted achromatic telescope was given in a paper to the Astronomical Society some years later (23). The early observations made at Wrottesley Hall resulted in a communication to the Royal Society which was published in the *Philosophical Transactions* for 1851 (2). In the case of stars which are optically double in consequence of being in the same line of sight, as opposed to physically double stars constituting a binary system, Herschel had shown that a variation in their angle of position should be observable, with a maximum variation occurring at two opposite seasons of the year. The Wrottesley equatorial was applied to this problem over a six-year period from 1843 to 1849. Substantial practical difficulties were encountered; of the sixty-nine double stars selected only forty-eight were observed, and only nineteen of these at both periods of the year. Wrottesley finally recommended two double stars as being worthy of the attention of other astronomers.

Following this ambitious, and not entirely successful, investigation, Wrottesley returned to the compilation of a further star catalogue. The British Association had published a new catalogue in 1845 and in January of 1850 he commenced a series of observations designed to perform the same service, in relation to the British Association catalogue, as his earlier observations had, for the Astronomical Society's catalogue. The actual observations and computations involved in this programme of work on 1009 stars were performed by Richard Philpott, who was employed by Lord Wrottesley as one of his assistants. The catalogue was eventually published in 1854 (24), but in introducing his paper, Wrottesley indicated that, in future, less of his time would be available for astronomical work. His own

words give a clear indication of the contribution which he felt himself most able to make (25).

> 'Indeed, having passed the meridian of life, and having now many other avocations that engross a considerable portion of my time, and which are likely to augment rather than diminish, I have long arrived at the conclusion that, however humble my powers may be, I can more effectually promote the interests of science in the way of counsel rather than action—in the cabinet rather than the field.'

A number of further contributions to astronomy were still to come, including, in 1860, a catalogue of the positions and distances of 398 double stars (26); immediately ahead, however, was his term of office as President of the Royal Society, and already Wrottesley was engaged in important activities in his capacity as Chairman of the Parliamentary Committee of the British Association. Gunther describes the decade 1820 to 1830 as 'one when astronomy was cultivated both in Great Britain and in the countries of Europe with an ardour that has been surpassed at no earlier period' (27): by the mid-century, G. B. Airy, the Astronomer Royal, estimated that 'In no country . . . is so much done for Science in private observatories and private laboratories as in this' (28). It is clear that Wrottesley contributed substantially to make both these judgements possible.

When the General Committee of the British Association met at Birmingham in 1849, a recommendation was adopted by which those members of the Association who were also members of the Legislature were requested to act as a permanent committee, watching over the interests of science and inspecting the various measures from time to time introduced into Parliament and likely to affect the welfare of science (29). Lord Wrottesley was one of six members entrusted with the responsibility of organizing this committee.

In 1851 the General Committee reported that the number of members of the Parliamentary Committee, as constituted by the Birmingham resolution, was too large for combined action. In consequence a smaller committee was established, comprising six members from each House, under the chairmanship of Wrottesley (30). The first report of this committee was received by the General Committee at Belfast in September 1852 and, although the membership changed substantially, annual reports, over Wrottesley's signature, were received until 1867. With his death in that year, the committee ceased to meet, but by that time, and in no small measure due to his work, objectives had become clearer and action of a different kind was thought appropriate.

In its early years the Parliamentary Committee concerned itself with a

variety of matters important for the growth of science. Improved facilities for the cheap and rapid international communication of scientific publications; pensions for eminent scientists; appropriate accommodation in a central situation for the principal scientific societies; international scientific co-operation, particularly in the scheme of the American, Lieutenant Maury, for analysing meteorological and oceanographic observations (31); these were all topics on which Government action was sought and achieved. It was in large measure due to the negotiations of Lord Wrottesley, acting also in his capacity as President of the Royal Society, that the Society was able to move in 1857 from Somerset House to Burlington House, the new accommodation being shared with the Linnean and Chemical Societies. Wrottesley foresaw a number of advantages as likely to accrue from this juxtaposition; there would be improved opportunities for scientists of different specialisms to meet informally; economic and other advantages would result from adjacent libraries; and the concentration of the major scientific societies in a building made available by the Government would add significantly to the prestige of science (32).

Nevertheless, it was clear by the mid-nineteenth century that widely differing views were held within the scientific community about the ways in which the future development of science should occur. The Astronomer Royal, in his Presidential Address to the British Association in 1851, drew attention, with approval, to the lack of any institution in Britain corresponding to a state-supported Academy of Sciences. In Airy's view 'this absence of Government-Science harmonises well with the peculiarities of our social institutions. In Science, as well as in almost everything else, our national genius inclines us to prefer voluntary associations of private persons to organisations of any kind dependent on the State' (33).

Wrottesley was less well-disposed towards future growth in accord with this principle of voluntaryism: a large number of small, uncoordinated societies would not be likely to gain recognition by the Government and be consulted and supported as the need arose. It was perhaps no accident that his early scientific work had been in the field of astronomy, where, amongst amateur and professional observers, a division of labour was well organized, and where the need for ever greater international co-operation was clearly discernible. The institutions of science needed a similar planned organization and growth if science was to be presented satisfactorily to the Government in matters such as applications for financial assistance, and if it was to contribute efficiently to the well-being of the nation (34).

With these problems in mind, the third report of the Parliamentary Committee in 1854 drew attention to a correspondence which Wrottesley

had commenced with various eminent scientists upon the question: 'Whether it might be possible to improve the position of science or its cultivators in this country by any measures to be adopted by Government or Parliament' (31). The respondents included Grove, Lyell, Herschel, Faraday, Airy and Sabine; their replies were analysed in the fourth report of the Committee presented at Glasgow in 1855 (35).

The substance of the report was organized under three headings, the second at least of which has a ring of topicality.

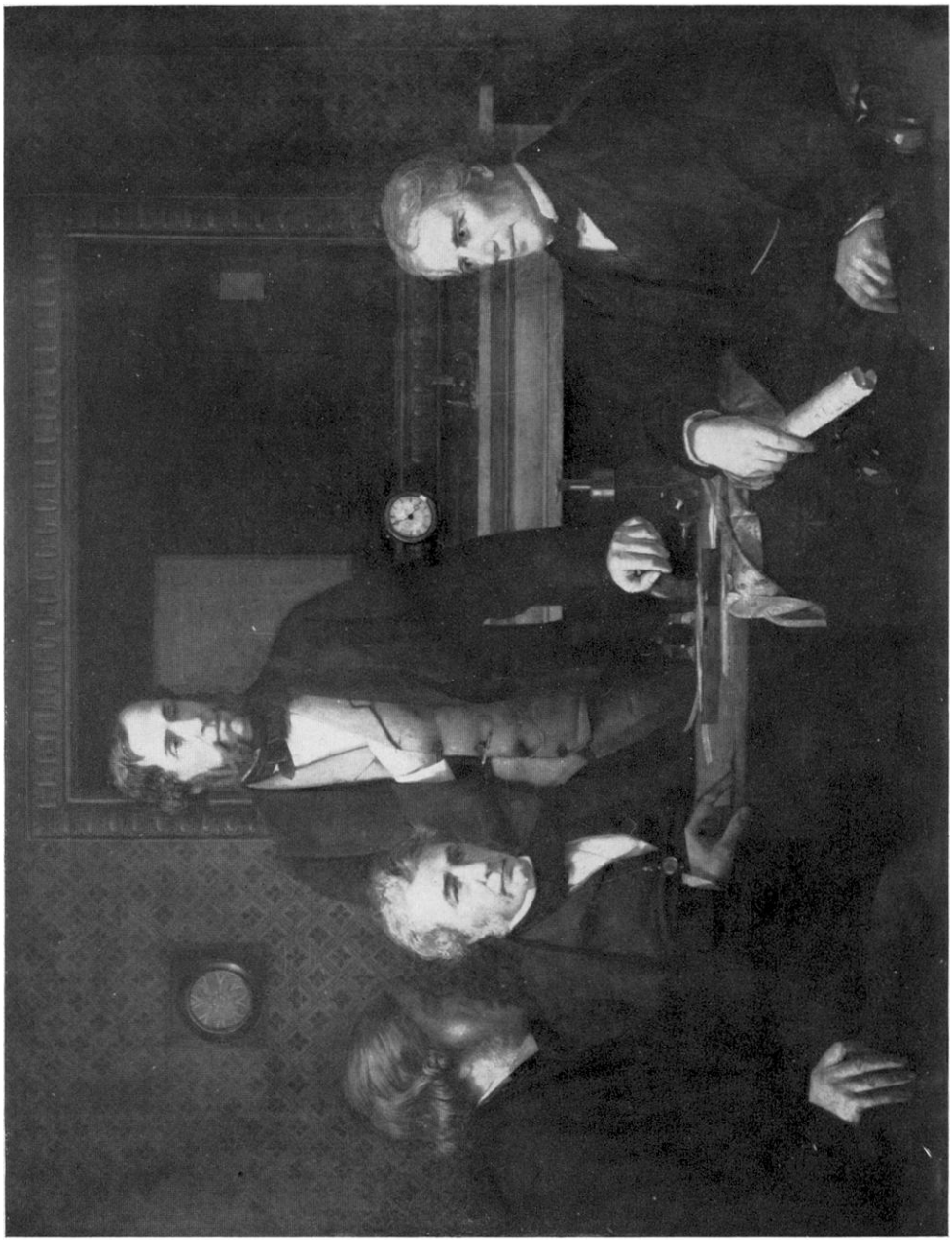
'1. How can the knowledge of scientific truths be most conveniently and effectually extended?
2. What inducements should be held out to students to acquire that knowledge; and, after the period of pupilage has expired, to extend it, and turn it to useful account?
3. What arrangements can be made to give to the whole body of competent men of science a due influence over the determination of practical questions, dependent for their correct solution on an accurate knowledge of scientific principles?'

The answers to the first of the questions were largely concerned with measures for the reform of the curricula of schools and universities; in addition, the report acknowledged the need to diffuse scientific knowledge throughout the entire community by the institution of provincial museums and libraries, accessible to all.

Under the second heading, the discussion of incentives to study science made reference to the need for increased scholarships to universities, improved salaries for scientists, and pensions as an acknowledgement of good service; there was also a consideration of the 'reward system' in science and a perceptive analysis of factors likely to influence the morale and productivity of scientists as members of a community. The report endorsed the need for a central building to house the principal scientific societies, a Capitol of Science: as Lord Rosse, a member of the Parliamentary Committee, and a former President of the Royal Society, expressed the matter: 'If a man, naturally gifted, and well educated, attends scientific meetings, he will feel himself constrained to work and therefore it is so important for the advancement of knowledge, that able men should be induced to join and attend the different societies' (36).

It is ironical today to find the report at pains to stress the value of pure as opposed to applied science. In a letter to Faraday in 1845 Liebig had commented on a national characteristic: 'What struck me most in England was the perception that only those works that have a practical tendency awake attention and command respect; while the purely scientific, which

Plate 19



Deputation from the Council consisting of Lord Wrottesley (President), Mr Grove and Mr Gassiot to Mr Faraday (May 1867), requesting him to be President. From a painting by E. Armitage in the possession of the Royal Society.

[*Facing page 236*

possess far greater merit, are almost unknown' (37). In 1966, the Swann Report on *Manpower Parameters for Scientific Growth* found it necessary to urge the need 'to change a widespread belief that academic research is the only respectable outcome of a scientific education' (38). The scientific community had been all too successful in achieving the prestige for abstract science which Wrottesley and his colleagues deemed essential.

In the third and final section of the report, consideration was given to the relations of science and government and a recommendation was made for the establishment of a Board of Science to advise the Government on scientific questions and be responsible for the distribution of Government grants (39). This issue was to receive further consideration in the Commons, when in June 1856 James Heywood, a member of the Parliamentary Committee, moved for 'a select Committee to inquire what public measures could be adopted to advance science' (40). His motion was critically received by the Chancellor of the Exchequer as lacking any distinct plan of action, at which Heywood's seconder, William Tite, in a speech noticeably lacking in circumspection, made clear that the object of the motion was not to secure more money for science, but to promote the establishment of a Board of Science. In reply, Palmerston appears to have wilfully misinterpreted the functions of the proposed Board, regarding it as an agency to which doubtful points of scientific knowledge might be referred; it was clear that no action could be expected and Heywood withdrew his motion.

The 1855 report of the Parliamentary Committee was not so easily shelved, however. By this time Wrottesley had succeeded the Earl of Rosse as President of the Royal Society, and brought the report to the notice of the Council who referred it to the important Committee of the Society which administered the recently awarded Government grant of £1000 (41).

Simultaneously, the General Committee of the British Association directed that the 1855 report of the Parliamentary Committee, together with a subsequent report, should go to all its members, with a request for an expression of opinions on the issues involved (42). A digest of the replies was prepared by John Phillips, the Assistant General Secretary of the Association. The two major scientific bodies in the country were thus canvassed for their views and at a special meeting of the Council of the Association on 16 January 1857, Wrottesley was able to announce that the Royal Society had adopted twelve resolutions (43). After discussion, the Council concurred, and the resolutions were communicated by Wrottesley to Palmerston, as Prime Minister, on 28 January 1857 (44).

In substance the resolutions were little different from the recommendations of the 1855 report; four related to educational measures; five to

measures designed to encourage scientific research; the final three resolutions related to the proposed Board of Science and to matters of finance.

It is a fact of history that the resolutions produced little immediate action; Palmerston's own position was by no means secure and his ministry was replaced by the Conservatives in February 1858. Subsequent reports from the Parliamentary Committee refer to lack of a convenient opportunity to submit the resolutions to the consideration of the Legislature (45). The work of the Parliamentary Committee continued, but 1858 was perhaps a turning point. Wrottesley resigned from the presidency of the Royal Society after a term of four years; an unsuccessful attempt was made to persuade Faraday to succeed him (46) and in the event the office fell to Sir Benjamin Brodie. It is clear from Brodie's remarks at a meeting of the Royal Society in December 1858 that his views on the relations of science and government were not in complete harmony with those of his predecessor (47) and Wrottesley himself in his address to the British Association in 1860 referred to influential members of the Parliamentary Committee who had expressed grave doubts as to the expediency of urging the adoption of the resolutions (48). It was not only the principles of voluntaryism and *laissez-faire*, applied to the growth of scientific institutions, which divided scientists; the proposed Board of Science was seen as usurping a function which might be performed by the Council of the Royal Society, suitably enlarged for the purpose (49).

Before Wrottesley's death, the British Association had appointed a new committee to consider in detail a special aspect of the matters covered by the 1855 report, the teaching of science in schools. In the final report of the Parliamentary Committee, Wrottesley commended the work of this new body whose suggestions so closely echoed the resolutions of a decade earlier (50).

At the Norwich meeting of the British Association in 1868, a year after Wrottesley's death, Colonel Alexander Strange, an Inspector of Scientific Instruments in the India Department, lately returned to this country, read an important paper 'On the Necessity for State Intervention to secure the Progress of Physical Science' (51). The events of the next two years culminated in the issuing of a Royal Commission to inquire into *Scientific Instruction and the Advancement of Science*. The Chairman was the seventh Duke of Devonshire, who for a decade had been a member of Wrottesley's Parliamentary Committee.

In the evidence to the Commissioners there was surprisingly little reference to the survey of scientific opinion which Wrottesley had conducted some fifteen years earlier. Strange was a major witness and many of the

issues he raised were identical with those which Wrottesley had previously brought before his scientific colleagues. Strange did not acknowledge any debt and was not lacking in modesty in agreeing with *The Times* in seeing himself as the main instigator of the Devonshire Commission and initiator of ideas on a Board of Science (52). It remained for some of his opponents to point out that the matters being discussed in 1872 were by no means new; Sir Edward Sabine, in particular, recalled the work of Wrottesley which 'brought us into the very matters that this Commission has had under its consideration lately' (53).

An obituary article on Wrottesley in the Athenaeum newspaper of November 1867 recorded that 'A stranger at the Royal Society would look with some surprise when he saw a quiet gentleman, utterly devoid of all mark of pretension, step into the chair of Newton'. By his contemporaries Lord Wrottesley was regarded as a man of 'plain manners, kind feelings, sound judgment and useful intellect' (54). In retrospect, he is seen as this and more; he was an early and distinguished pioneer in the administration of science at a time when it was emerging as an important national asset.

Appendix

Copy of the Letter from the President of the Royal Society to Viscount Palmerston, with Resolutions of the Council of the Royal Society enclosed.
(*Pursuant to an Order of the* House of Lords, *dated 18th June* 1857.)

Wrottesley,

My Lord, Jan. 28, 1857.

In the last Session of Parliament, the House of Commons was, on the Motion of Mr. Heywood, called upon to appoint a Committee to consider what Measures could be adopted that would improve the Relations between the Government and Science. On that Occasion your Lordship is understood to have expressed the Readiness of the Government to take into consideration any Proposals that should receive the Sanction of the principal Cultivators of Science. It appeared to the Council of the Royal Society, and also to the Governing Body of the British Association, so desirable that the Government and Parliament should know the Opinions of Men of Science on Questions of such paramount Interest, that they took Measures during the last Summer to obtain such Opinions, and with this view almost every one was consulted

who had contributed a Paper to the Transactions of any Chartered Scientific Society.

I have now the Honour to enclose the Resolutions which, after duly considering the Replies received, and much earnest Deliberation, were adopted by the Council of the Royal Society, and approved by that of the British Association. These Resolutions may be regarded as representing the Sentiments of the greater Part of the Cultivators of Science in the United Kingdom on Questions of which it is difficult to overrate the Importance both to Science and the Nation at large.

I have, &c.

(Signed) WROTTESLEY, P.R.S.

Authentic Copy of the RESOLUTIONS *of the* COUNCIL *of the* ROYAL SOCIETY *enclosed in the above Letter.*

ROYAL SOCIETY.

RESOLUTIONS adopted by the President and Council on the Question, "Whether any Measures could be adopted by the Government or Parliament that would improve the Position of Science or its Cultivators in this Country".

1. The President and Council regard with much Satisfaction the Steps already taken in the Universities for advancing the Study of Physical Science by including several Branches of it in the Public Examinations, and express their Hope that the Improvement thus introduced may receive the Extension which the Interests of Science require, and that the Public Schools may be thereby induced to make Physical Science an integral Part of their Course of Education.

2. The President and Council recommend that the Establishment of Classes in Metropolitan and Provincial Schools, where those who have not the Means or Opportunity of studying at the Universities may be taught the Elements of Physical Science on a systematic Plan, be promoted by Grants from Government in aid of such Funds as may be locally contributed for that Purpose.

3. That the Formation of Provincial Museums and Libraries be encouraged in like Manner, and that Provincial Lectures, accompanied by Examinations, be established in Great Britain in Towns which request this Assistance and engage to provide a Part of the Expense, such Lectures to be

in aid of the Schools above mentioned, so that by means of the Two combined a sound Knowledge of the Principles and Applications of Science may be systematically taught.

4. That duplicate Specimens from the British Museum and other Institutions supported at the Public Expense be distributed to Provincial Museums.

5. That National Publications bearing on Science be more extensively circulated than they are at present, by additional Donations to Societies and Individuals engaged in the Cultivation of Science.

6. That the Sum placed annually by Parliament at the Disposal of Government for the Reward of Civil Services, "useful Discoveries in Science, and Attainments in Literature and the Arts", be augmented; that the Portion to be appropriated to Science be defined; and that it be sufficiently large to admit of the Grant of Annuities of the Nature of Good-Service Pensions, as Rewards of eminent Scientific Merit.

7. That the Sum placed at the Disposal of the Royal Society for the Advancement of Science be not necessarily limited to the annual Grant of £1,000, when on any Occasion special Reasons may be assigned for an additional Sum.

8. That scientific Offices shall be placed more nearly on a Level in respect to Salary, with such other Civil Appointments as are Objects of Ambition to educated Men.

9. The President and Council regard with much Satisfaction the Steps already taken for the Concentration of the principal Scientific Societies in Burlington House; and trust that the Period is not far distant in which permanent Accommodation will be afforded to the principal Scientific Societies in Buildings to be erected near the same Site, and in pursuance of the same general Plan.

10. While it may not be expedient to interfere in any way with the Functions confided to the President and Council of the Royal Society, in reference to the Distribution of the Parliamentary Grant, or with the ancient and recognised Relations between the Royal Society and the Government, at the same Time is appears to the President and Council that much Benefit would arise from the formal Recognition of some Board which might advise the Government on all Matters connected with Science, and especially on the Prosecution, Reduction, and Publication of Scientific Researches, and the Amount of Parliamentary or other Grants in aid thereof; also on the general Principles to be adopted in reference to Public Scientific Appointments; and on the Measures necessary for the more general Diffusion of a Knowledge of Physical Science among the Nation at large; and which might

be consulted by the Government on the Grants of Pensions to the Cultivators of Science.

11. Assuming that the above Proposal should meet with the Approval of Her Majesty's Government, it will be desirable to ascertain what Mode of constituting such a Board would inspire them with most Confidence in its Recommendations. Two Modes may be suggested in which such a Board might be organized: First, the Government might formally recognise the President and Council of the Royal Society as its official Adviser, imposing the whole Responsibility on that Body, and leaving it to them to seek Advice, when necessary, in such Quarters as it may best be found, according to the Method now pursued in the Disposal of the Parliamentary Grant of £1000. The Second Method would be to create an entirely new Board, somewhat after the Model of the old Board of Longitude, but with Improvements. The Question as to which Alternative shall be adopted is properly a Subject for the Consideration of the Government.

12. Such of the above Recommendations as involve the Expenditure of Money might be eventually carried out by appropriating to this Purpose a certain Proportion of the Fees received from the Grantees of Patents, after providing for all Expenses which ought to be defrayed from that Source. The President and Council are satisfied that no Application of these Fees could be devised more appropriate than the Devotion of a Portion of them to the Encouragement of Abstract Science, to which Practical Art is under so many and such important Obligations.

Notes

(1) *Proc. R. Soc.* **9**, 569 (1859). The factors determining the allocation of credit for scientific work have been studied more recently by sociologists: Wrottesley, along with other secondary figures, might be seen as a victim of the 'Matthew effect'.

> 'For unto everyone that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that he hath.' St. Matthew, Ch. 25, v. 29.

The theme is developed by Robert K. Merton, 'The Matthew Effect in Science', *Science, N.Y.* **159**, 56–63 (1968).

(2) Lord Wrottesley, 'On the Results of Periodical Observations of the Positions and Distances of Nineteen of the Stars in Sir John Herschel's List of Stars, favourably situated for the investigation of Parallax, contained in Part III of the Philosophical Transactions for 1826, and Part I, 1827'. *Phil. Trans. R. Soc.* pp. 333–356 (1851).

(3) *Proc. R. Soc.* **10**, 133–146 (1860).

(4) This is Wrottesley's own statement of his aims, as given in his first Anniversary address to the Royal Society. *Proc. R. Soc.* **7**, 570 (1856).

(5) *Ibid.* **7**, 560 (1856).

(6) *Rep. Br. Ass. Advmt Sci.* **24**, xlii (1855).

(7) Wrottesley brought the notion of a Board of Science to the attention of the Fellows of the Royal Society in his presidential address on 30 November 1855. *Proc. R. Soc.* **7**, 564 (1856).

(8) See e.g. *Hansard's Parliamentary Debates*, Third Series, CLXXVIII, columns 1460–1464 (1865).

(9) Wrottesley made one of his infrequent speeches in the House of Lords on 26 April 1853, urging that England should send delegates to the international conference on marine meteorology. Eventually his view prevailed and two British delegates attended at Brussels when the conference opened, under the presidency of Quetelet, on Tuesday, 23 August 1853. The full story of the conference, and of Wrottesley's part in assisting the American prime mover, Lieutenant Maury, is told in:

Williams, Frances Leigh, *Matthew Fontaine Maury. Scientist of the Sea*. New Jersey: Rutgers University Press (1963).

Wrottesley's long speech is recorded in *Hansard's Parliamentary Debates*, Third Series, CXXVI, columns 521–539 (1853). It was later published as a pamphlet.

(10) See e.g. Crowther, J. G. *Statesman of Science*. London: The Cresset Press (1965), for a consideration of Grove, Playfair and Strange.

Jones, R. V. 'Science and the State', *Nature, Lond.* **200**, 7–14 (1963); 'Lyon Playfair, 1818–98', *Nature, Lond.* **200**, 105–111 (1963).

(11) Russell Barker, G. F. and Stenning, Alan H. (Compilers). *The Record of Old Westminsters*, **2**, 1027. London (1928).

(12) Carleton, J. D. *Westminster School*. London: Hart-Davis (1965), p. 44.

(13) A history of the family of Wrottesley is given in *Collections for a History of Staffordshire*, edited by the William Salt Archaeological Society, Vol. VI, New Series, Part II, London (1903). The author, Major-General the Hon. George Wrottesley, was the third son of Lord Wrottesley, the subject of this paper. See particularly pp. 377–382.

(14) Maxwell Lyte, H. C. *A History of the University of Oxford*. London (1886), p. 186.

(15) Foster, Joseph. *Alumni Oxonienses: the members of the University of Oxford 1715–1886*, Vol. IV, Later Series, Oxford (1891), p. 1617.

(16) Mallet, C. E. *A History of the University of Oxford*, Vol. III. London: Methuen (1927), p. 169.

(17) Bishop, G. D. *Physics Teaching in England from Early Times up to 1850*. London: P.R.M. Publishers Ltd. (1961), p. 108.

(18) *D.N.B.* Vol. XLVIII, London (1896), p. 298. Entry under Stephen Peter Rigaud (1774–1839).

Gunther, R. T. *Early Science in Oxford*, Vol. XI, Oxford (1937), p. 100 gives details of Rigaud's ancestry: not only had his father been Astronomer Royal at Kew, but his mother was the daughter of Stephen Charles Triboudet Demainbray (1710–1782), tutor to George III and astronomer at the Royal Observatory, Kew, from 1768 to 1782.

(19) *Rep. Br. Ass. Advmt Sci.* **30**, lv (1861).

(20) Wrottesley was one of the original founders of the Society for the Diffusion of Useful Knowledge and retained his interest in the work of the Society throughout his life. In 1828, when Charles Knight, the publisher, was encouraged by Lord Brougham to produce a modern, scientifically-based Almanac he was told: 'You shall have help enough. There's Lubbock and Wrottesley and Daniel [*sic*] and Beaufort—you may

have your choice of good men for your astronomy and meteorology, your tides and your eclipses.'

Knight, C. *Passages of a Working Life*, Vol. II. London (1864), p. 62.

(21) *Mem. R. Astr. Soc.* **10**, 157–234 (1838).

(22) *Mem. R. Astr. Soc.* **12**, 103–117 (1842).

(23) *Mon. Not. R. Astr. Soc.* **14**, 69–74 (1854).

(24) *Mem. R. Astr. Soc.* **23**, 1–51 (1854).
See also: *Mon. Not. R. Astr. Soc.* **14**, 69–74 (1854); **15**, 104–105 (1855).

(25) *Mon. Not. R. Astr. Soc.* **14**, 74 (1854).

(26) *Mem. R. Astr. Soc.* **29**, 85–168 (1861).
Mon. Not. R. Astr. Soc. **20**, 286–287 (1860).
For further details of Lord Wrottesley's astronomical work, and for a contemporary evaluation, see the obituary notice in *Mon. Not. R. Astr. Soc.* **28**, 64–68 (1868).

(27) Gunther, R. T. *Early Science in Oxford*, **2**, Oxford (1923), p. 92.

(28) *Rep. Br. Ass. Advmt Sci.* **21**, li (1852).
Gunther lists 25 private observatories in Britain in 1830, including Wrottesley's observatory at Blackheath: *Early Science in Oxford*, **2**, Oxford (1923), p. 93. In his presidential address to the B.A. in 1860, Wrottesley referred to 'no less than twelve private Observatories in the United Kingdom' listed in the *Nautical Almanac*. His address also includes a consideration of the scope of the activities of the private, voluntary institutions and of the 'public' observatories such as Greenwich. See e.g. *Rep. Br. Ass. Advmt Sci.* **30**, lx (1861).

(29) *Rep. Br. Ass. Advmt Sci.* **19**, xix–xx (1850).

(30) *Rep. Br. Ass. Advmt Sci.* **21**, xxv–xxvi (1852).

(31) *Rep. Br. Ass. Advmt Sci.* **24**, xlii (1855).
Also: *Proc. R. Soc.* **7**, 561–562 (1856).

(32) *Proc. R. Soc.* **7**, 566–567 (1856).

(33) *Rep. Br. Ass. Advmt Sci.* **21**, li (1852).

(34) Wrottesley made this point explicitly in his second Anniversary address to the Royal Society on 1 December 1856.
'Thus has a division of labour in astronomical research been fairly organised; and I cannot but think that the principle might be carried very much further with great advantage to the progress of knowledge.' *Proc. R. Soc.* **8**, 248 (1857).

(35) *Rep. Br. Ass. Advmt Sci.* **25**, xlviii–lxiii (1856).

(36) *Rep. Br. Ass. Advmt Sci.* **25**, liv (1856).

(37) *Rep. Br. Ass. Advmt Sci.* **25**, lvi (1856).
Leibig's letter was cited in Lyell, C. *Travels in North America*, Vol. I. London (1845), p. 309. It was also quoted in the House of Commons by William Tite: see reference (40) below.

(38) Committee on Manpower Resources for Science and Technology. *Interim Report of the Working Group on Manpower Parameters for Scientific Growth*. London: H.M.S.O. (1966), p. 26.

(39) *Rep. Br. Ass. Advmt Sci.* **25**, lxii (1856).

(40) *Hansard's Parliamentary Debates*, Third Series, CXLII, columns 1263–1273 (1856).

(41) *Proc. R. Soc.* **8**, 243 (1857).

(42) *Rep. Br. Ass. Advmt Sci.* **26**, xl (1857).

(43) *Rep. Br. Ass. Advmt Sci.* **27**, xxviii-xxix and xxxviii (1858).

(44) Parliamentary Paper No. 63, 1857, Session 2, XVII, 249; in the House of Lords' Library. [Wrottesley's letter to Palmerston and the twelve resolutions are given in an appendix to the present article (p. 239).]

(45) See e.g. *Rep. Br. Ass. Advmt Sci.* **27**, xxxviii (1858), and **28**, xxxviii (1859).

(46) Tyndall, John, *Faraday as a Discoverer*, London (1870), 2nd edition, p. 191.

Tyndall records: 'When the late excellent and lamented Lord Wrottesley resigned the presidency of the Royal Society, a deputation from the council, consisting of his Lordship, Mr. Grove, and Mr. Gassiot, waited upon Faraday, to urge him to accept the president's chair.' After a customary interval for reflection, and despite Tyndall's encouragement, Faraday declined the invitation.

(47) *Proc. R. Soc.* **9**, 567 (1859).

(48) *Rep. Brit. Ass. Advmt Sci.* **30**, lxvi (1861).

(49) Lord Rosse, Wrottesley's predecessor as President of the Royal Society, had advocated an increase in the number of Council members who 'have high general education, and are men of the world and of influence', as an alternative to the establishment of a Board of Science: see e.g. *Proc. R. Soc.* **7**, 564 (1856). Wrottesley returned to the questions of the organization of scientific activity and the relations of science and the state in his final address at the anniversary meeting of the Royal Society on 30 November 1858. After contrasting the English and French systems, he concluded:

'The blots in our system seem to be, first, that there is a great want of combined action between the various communities representing Science; an evil, which might possibly be remedied by some joint representation of the whole; and secondly, that the Societies instituted for the promotion of the various branches of science . . . are not officially recognised in any way as authorities, or appealed to except occasionally and by accident . . .'

Proc. R. Soc. **9**, 508 (1859).

In his views on the organization of science, Wrottesley was in advance of his times. As Dicey puts it: 'English statesmanship was at the middle of the Victorian era . . . grounded on the *laissez-faire* of common sense. . . . The State, it was thought, ought not as a matter of prudence to undertake any duties which were, or which could be, performed by individuals free from State control.'

Dicey, A. V. *Lectures on the Relation between Law and Public Opinion in England during the Nineteenth Century*. London: 2nd Edition (1952), p. xxix.

No doubt some of Wrottesley's critics had in mind the fate of the recently instituted Board of Health, which had been given powers to investigate local conditions and coerce local authorities, following a series of epidemics which directed Government attention to questions of drainage and water supply. The Board lasted for six years only and its abolition was applauded.

'The Benthamism of bureaucratic organization had overshot the mark and was defeated by the more popular Benthamism of *laissez-faire*. *The Times* was delighted. "We prefer", says its leader-writer, "to take our chance of cholera and the rest, rather than be bullied into health . . ." '

Somervell, D. C. *English Thought in the Nineteenth Century*. London (1929), p. 84.

(50) *Rep. Brit. Ass. Advmt Sci.* **37**, lxi (1868).
(51) *Rep. Brit. Ass. Advmt Sci.* **38**, Notes and Abstracts, 6–8 (1869).
(52) See e.g. *J. R. Soc. Arts*, **18**, 446 (1870).
Nature, Lond. **13**, 409 (1876).
(53) Royal Commission on Scientific Instruction and the Advancement of Science. *Minutes of Evidence, Appendices, and Analyses of Evidence*, Vol. II. London (1874), p. 139.
54) *The Athenaeum Journal of Literature, Science and the Fine Arts*, No. 2088, 574 (1867).