

powers of hereditary rulers. In his view the narrow liberties enjoyed by his subjects, under the Constitution reluctantly granted by William IV. in 1833, were excessive and intolerable. He suspended the Constitution, and thereby called forth vigorous protests from Dahlmann and other Professors of the Hanoverian University. As a punishment, seven of them—Dahlmann, Weber, the two Grimms (Jacob and Wilhelm), Albrecht, Gervinus, and Ewald—were ejected from their chairs, and Gervinus, Dahlmann, and Jacob Grimm were even expelled from the country. From this time Weber lived for some years in retirement, but in 1843 he accepted the Professorship of Physics in Leipzig (in succession to Fechner), and in 1849 he returned to his former position in the University of Göttingen. He was in Göttingen at the time of his death.

Wilhelm Weber's eldest brother, Ernst Heinrich, was the celebrated Professor of Anatomy and Physiology at Leipzig. He was born at Wittenberg in 1795, and died at Leipzig in 1878, having been elected a Foreign Member of the Royal Society of London in 1862. The youngest of the three brothers, Eduard Friedrich, was also highly distinguished as an anatomist, and held office for many years in the University of Leipzig.

Weber's first contribution to science at once took rank as a scientific classic, a position it is likely to keep for many years to come. This was "Die Wellenlehre auf Experimente gegründet," a volume of 574 pages, and 18 copper plates, nearly all engraved by the authors, published in 1825 by the brothers Ernst and Wilhelm Weber, and embodying the results of numberless original experiments and observations. One of the most striking results of these investigations was the discovery that, when a regular series of waves follow each other along the surface of water, the particles at the surface describe vertical circles whose plane is parallel to the direction of propagation of the waves, and those lower down ellipses of which the vertical axis becomes smaller and smaller with increasing depth. As to the composition of this work, the authors say that it grew up as the result of such constant and intimate communication between them with regard to all parts, that it is impossible to assign to either of them the separate authorship of any distinct portions.

For several years Weber continued to occupy himself mainly with questions of acoustics, on which he published various papers of importance. In 1833 he published, in conjunction with his brother, Eduard Friedrich, a memorable investigation into the mechanism of walking "Mechanik der menschlichen Gehwerkzeuge".

But it is chiefly by his magnetic and electrical researches that Weber's place in the history of science is marked. These are contained for the most part in the "Resultate aus den Beobachtungen des magnetischen Vereins," published by Gauss and Weber from 1837 to 1843, and in Weber's "Elektrodynamische Maassbestimmungen" (published in collected form in 1864, though the first paper dates from 1846). In this series of papers Weber showed for the first time how methods of absolute measurement, analogous to those which Gauss had very shortly before shown to be applicable to magnetic measurements, could be extended into the region of electricity. Before this time Ampère's splendid discoveries as to the laws of the mutual forces between magnets and conductors traversed by electric currents, or between two such conductors, had been made known, and G. S. Ohm had established once for all the relations between electrical resistance, electromotive force, and strength of current; but, nevertheless, there was as yet no settled system for the measurement and statement of electrical quantities themselves. Until Weber's time electrical measurements were merely comparisons between magnitudes of the same kind: the resistance of one conductor could be compared with that of a particular piece of wire, the electromotive force of one

battery could be compared with that of another; but that the value of an electrical quantity could be stated without reference to any quantity of the same kind, and in terms not involving any physical constants but the units of length, time, and mass, was as yet an entirely new conception. Weber, however, not only showed that such a system of measurements was theoretically possible, but in a series of most masterly experimental investigations he showed how it could be practically carried out. Our countryman Sir William Thomson was one of the very first men of science to recognize the fundamental character and far-reaching importance of Weber's work; and owing mainly to his clear-sighted advocacy of the absolute system of measurement, this system was from the first adopted as the basis for the operations of the British Association Committee on Electrical Standards, appointed originally in 1862. This system has now become so familiar to electricians, and is taken so much as a matter of course, that it requires some mental effort to recall the state of science when it did not exist, and to appreciate the intellectual greatness of the man to whom it is due. If we consider method and point of view, rather than acquired results, it is not too much to say that the idea of absolute measurements, underlying as it does the conception of the conservation of energy, constitutes the most characteristic difference between modern physics and the physics of the early part of our century. And to no one man is so large a share in this great step due as to Wilhelm Eduard Weber.

Weber was a Corresponding Member of the Institute of France. He was elected a Foreign Member of the Royal Society in 1850. G. C. F.

A SOUVENIR OF FARADAY.

THE following letter, written by an old friend of Faraday's and of mine, long since dead, may interest your readers, now that we are celebrating the centenary of Faraday's birth. It came in reply to one in which I asked Mr. Ward's assistance in preparing an obituary notice of Faraday for the *Chemical News*.

WILLIAM CROOKES.

Cornwall, August 30, 1867.

DEAR CROOKES,—I should be proud indeed to be the spokesman of the chemical world in doing honour to Faraday's illustrious name on the occasion of his accession to immortality.

But I should not dare to meddle with the laurels on so august a brow, without many days and nights of earnest research and meditation, to fit me for summing up, without omission, the splendid list of his imperishable labours.

Only in this reverential spirit of earnest solicitude to do aright, which is, if I mistake not, the philosophical counterpart of prayer—of the religious feeling—could so solemn a duty be fitly undertaken.

Only with the aid of other minds, kindred with Faraday's in genius, and filled with the light of his manifold discoveries, could any one man's mind become an adequate mirror to reflect the gigantic Shadow that has just passed to its place in futurity.

For the present it is my fate to fulfil much humbler duties—which, having undertaken, I have no right to set aside. For duty must still be done, even when such appeals as yours set the wings of the caged lark trembling, and point him upwards to his barred out home.

I must remain, therefore, a unit among the millions whose hearts do silent homage to the illustrious dead; and can but watch from afar the starry coronation of which you invite me to be minister.

So best, perhaps. For, after all, the name and fame of

Faraday transcend all pomp of celebration, all burning words of praise. For whose the pen to weave so bright a glory as that electric fire which glows, through all the ages, round his brow, who first drew lightning from the lodestone, as Franklin drew it from the sky?

In the moment of separation that little spark breaks forth—instantaneous yet eternal. It is but one vivid point of the radiance that encircles his name, yet of itself it is glory enough.

From that spark a new branch of science has sprung, and under its creator's name, were it mine to carve his epitaph, these three should be the chosen words:—

FULMEN ERIPUIT FERRO!

Ever yours faithfully,

F. O. WARD.

NOTES.

WE print elsewhere an account of the fourth annual meeting of the National Association for the Promotion of Technical and Secondary Education. After the meeting an important conference was held, and it is now hoped that all the influences which are tending towards the establishment of a proper system of technical instruction in England may soon be thoroughly organized. Next week we shall have something to say about the work of the conference and about the Association's report.

THE *conversazione* given by the President of the Institution of Electrical Engineers, Prof. Crookes, F.R.S., and Mrs. Crookes, on Monday evening, was brilliantly successful. It was held in the galleries of the Royal Institute of Painters in Water Colours, Piccadilly. There were about 800 guests, among whom were many eminent men of science.

ON Tuesday evening the Fellows of the Royal Meteorological Society and their friends dined together at the Holborn Restaurant, to celebrate the entrance of the Society upon its new premises in Great George Street, Westminster. Mr. B. Latham, the President, occupied the chair. Mr. A. R. Binnie (Engineer to the London County Council) proposed "The Royal Meteorological Society," and Mr. G. J. Symons responded. Mr. Latham, replying to the toast of "The President," referred to the enormous amount of records in the possession of the Society. All they now wanted was a few more members. However, they had gone on increasing, and were now in a prosperous state, as they had been able to collect from the members of the Society a considerable sum of money, which had been funded, and the interest on which would meet the expenses of the new establishment. The Society now possessed one of the finest meteorological libraries in the world, and one which would be of enormous value to future generations.

WE are glad to note that the Marine Biological Association have now only three unoccupied tables. Many investigators are taking advantage of the facilities offered them at Plymouth.

THE Exhibition Committee of the Photographic Society of Great Britain announce that the annual exhibition of that Society will be held at the Gallery of the Royal Society of Painters in Water Colours, Pall Mall East, from Monday, September 28, until Thursday, November 12 next. The exhibition will be open daily (Sundays excepted) from 10 a.m. to 5 p.m., and on Monday, Wednesday, Thursday, and Saturday evenings from 7 p.m. to 10 p.m. Medals will be awarded for artistic, scientific, and technical excellence of photographs, for lantern transparencies, and for apparatus.

THE Pacific Postal Telegraph Company had lately a gathering of some 500 guests at the opening of a new telegraph office

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in San Francisco. After shortly describing the various instruments, Mr. Storrer, the superintendent, said he was often asked how long it took to telegraph to different places and get a reply. He would therefore now send a telegram to Portland, New York, Washington, Seattle, Tacoma, Canso (Nova Scotia), and London, inquiring about the weather. The first reply came from Portland in 3 minutes, "Weather fine"; the next from New York in 3 minutes 10 seconds, "Misty and warm"; Washington in 3 minutes 11 seconds, "Misty and warm"; Seattle in 3 minutes 21 seconds, "Misty and calm"; Tacoma in 3 minutes 28 seconds, "Misty, cool, and calm"; Canso, Nova Scotia, in 4 minutes 20 seconds, "Cold and misty"; while the answer "Misty and cold" came from London in 6 minutes 22 seconds.

THE Governors of the Royal Holloway College have appointed Miss M. W. Robertson to the Resident Lectureship in Natural Science. Miss Robertson, who is now a lecturer on the staff of Alexandra College, Dublin, has taken the degrees of B.A. and M.A., with high honours in chemistry and physics, at the Royal University of Ireland, and has also gained the University Studentship in Experimental Science.

THE Education Department has issued a memorandum, by Mr. J. G. Fitch, on the working of the free school system in America, France, and Belgium.

THE death of M. Rodolphe Koepelin, a distinguished chemist, is announced. He was born at Colmar in 1810, and from 1828 to 1859 held the Chair of Physics and Natural History at the College of his native town. For many years he was intimately connected with the Agricultural Society of the Upper Rhine, and, as a chemist, he was able to render great services to the agriculturists of his department. After the Franco-German war, M. Koepelin quitted Alsace, and settled in Paris, where he was regarded as one of the most eminent members of the Alsatian colony.

IN another part of the paper we print a report, by Herr O. Jesse, of his observations of luminous clouds in the summer of 1890. We learn from Herr Jesse that on the night of June 25-26 last the luminous clouds were again very visible at Steglitz and Nauen, and that they were photographed eight times simultaneously at these two places. Writing to us from Sunderland on July 1, Mr. T. W. Backhouse says there was a fine display of the luminous clouds during the previous night, their motion being, "as usual, from a north-easterly direction." Mr. D. J. Rowan informs us that on the same night, from 11.30 p.m. to 12.30 a.m., the clouds, as seen at Kingstown, co. Dublin, "appeared well-developed on a polar arc of 30° and at a mean altitude of 5°." They had been faintly visible at Kingstown on June 3, 7, and 9. It is astonishing that no observer seems yet to have had energy and intelligence enough to take spectroscopic photographs of these striking phenomena.

ACCORDING to a telegram from Melbourne, dated July 4, the Swedish-Australian Antarctic Committee of the Victorian branch of the Royal Geographical Society, which was formed to raise subscriptions in order to take advantage of Baron Nordenskiöld's offer to equip an expedition to the Antarctic regions, announces that a sum of £3000 only is required to complete arrangements, and that there is every prospect of the expedition starting in about fifteen months' time. It is expected that the expedition, in addition to its geographical and other scientific discoveries, will be the means of opening up extensive whale and other fisheries in the Antarctic seas.

WE learn from the *Botanical Gazette* that Lieut. R. E. Peary, of the U.S. Navy, proposes to reach the North Pole on foot through Greenland, starting from Whale Sound, and