THURSDAY, JUNE 10, 1875

THE METEOROLOGICAL OFFICE

Quarterly Weather Report of the Meteorological Office. Published by the authority of the Meteorological Committee, January 1869, to September 1873. Hourly Readings from the self-recording instruments at the seven Observatories in connection with the Meteorological Office, January to September 1874.

THE self-recording instruments which have been in operation at the seven Observatories of the Meteorological Committee since January 1869, may be regarded as the best and most complete anywhere existing for recording continuously the atmospheric pressure, temperature, humidity and rainfall, and the velocity and direction of the wind. To ensure correctness in the work, and accurate tabulation of the results, minute regulations with respect to the officials at the outlying Observatories, the assistant at the Central Observatory, and the director of the Central Observatory, were laid down in the Committee's Report for 1868, p. 62. Thus, as regards the thermograph, twenty-seven regulations were laid down, one of the most important of these being the 25th, by which it was provided that forty remeasurements from each month's curves were to be made at Kew, the central Observatory ; and a table is given (page 39 of the same Report) of the results of measurements which were specially designed for the detection of *small errors* in the thermograph tabulations, from which it appears that refinements as minute as the one-hundredth of a degree of temperature were taken cognisance of in the results.

Tracings of the curves, and five-day and monthly results of the tabulations, though not the tabulations themselves, have been published, beginning with 1st January, 1869; and since then many and great improvements have been made in representing the curves on the Plates, all in the direction of greater clearness and precision, for which the Committee deserve our best thanks. Among the many valuable results of these curves we may point to the high temperature at Glasgow on the 21st April, 1873, in connection with the remarkable changes in the direction and force of the wind which occurred at the time ; to the heavy rainfall at Valencia on the 2nd July, 1873, in connection with the changes of wind, temperature and pressure ; and to the minute oscillations of pressure at almost all the Observatories on the 3rd and 4th July, 1873, in connection with the changeable weather at the time. In these connections the absence of any observations of clouds is, however, a serious defect.

One of the principal objects for which the seven Observatories were established was to furnish the data of observation for the determination of the meteorological "constants" for pressure, temperature, rainfall, &c., for different parts of the British Isles. This being now the seventh year in which this expensive system of observation is going forward, it may be well to inquire how far the information, as published by the Meteorological Office, meets the requirements of the problems to be solved.

Assuming that the curves are correctly traced from the photographs, we may inquire whether the figures tabulated from these, under the regulations referred to above, be satisfactorily accurate. No hourly values having been printed before January 1874, the question can only be answered by an examination of the printed monthly maxima and minima, with the days and hours of their occurrence, as compared with the curves. The following Table, giving the extreme readings of the thermometer for each of the Observatories for January 1869, is here reprinted verbatim from the Quarterly Weather Report for 1869, Part I., p. 34 :—

	Maximum.	Day and Hour.	Minimum.	Day and Hour.
Valencia ...	53°·7	4th, 4 A.M.	37°·0	22nd, 3 A.M.
Armagh ...	53°·1	16th, 2 P.M.	31°·9	26th, 2 A.M.
Glasgow ...	50°·1	5th, 10 A.M.	29°·5	26th, 7 A.M.
Aberdeen ...	48°·8	31st, 6 P.M.	30°·6	26th, 8 A.M.
Falmouth ...	54°·0	30th, noon.	36°·0	24th, 9 A.M.
Stonyhurst...	51°·8	31st, noon.	28°·4	25th, 2 A.M.
Kew	55°·3	30th, 6 P.M.	27°·6	25th, 7 A.M.

Each datum of this table we have compared with the temperature curves for the month, measuring each observation four times, viz., by the side scales of each curve from below upwards, and from above downwards. Setting aside every reading which does not differ from the measured reading so much as 0°·4 of a degree, and the discrepancies which appear to arise from the unequal shrinkage of the paper as indicated by the results of the four measurements, there are in the above Table twelve errors, the maxima at Falmouth and Kew being doubly wrong, the amount at the given hours being wrong, and the date of occurrence being also wrong. The following is the Table as corrected, the corrected readings being shown by asterisks :—

	Maximum.	Day and Hour.	Minimum.	Day and Hour.
Valencia ...	53°·7	* 5th, 4 A.M.	37°·0	22nd, 3 A.M.
Armagh ...	*53°·6	16th, 2 P.M	*32°·3	26th, 2 A.M.
Glasgow ...	*50°·9	5th, 10 A.M.	*27°·0	* 1st, 2 A.M.
Aberdeen ...	48°·8	31st, 6 P.M.	*28°·7	* 1st, 4 A.M.
Falmouth ...	*54°·9	*31st, 11 P.M.	36°·0	24th, 9 A.M.
Stonyhurst...	51°·8	31st, noon.	*22°·8	* 1st, 8 A.M.
Kew	*55°·8	*31st, 1 P.M.	27°·6	25th, *5 A.M.

It will be observed that the errors are of three sorts—(1) errors of temperature and errors of the date of occurrence of the maxima and minima, including (2) errors of the day of the month, and (3) errors of the hour of the day. Similarly the other months of 1869 have been examined, with the result that forty-one errors of temperature varying from 0°·4 to 9°·6 † have been detected, that the day of the month, as printed, is wrong on twenty-two occasions, and that the hour of the day is wrong in nine cases, in which the temperature and day of the month are correct—in all, seventy-two errors. The Tables and curves for ten months, taken indiscriminately from the other years, have also been examined.

In the Tables for April and June 1870 (p. 37 of the Quarterly Weather Report of that year) there occur six errors in each of these months, and in the Table for March 1871 (p. 26 of Q. W. Report for 1871) there occur seven errors. In none of the twenty-two months examined are there

† The minimum temperature at Glasgow for October is given as 39°·9 at p. 109 of Q. W. Report, instead of 30°·3 as by the curve of temperature (Plate cxix.).

fewer than two errors. This is the number of errors in the Table for August 1873 (p. 42 of Q. W. Report for 1873), being the last month for which the whole of the curves have been published. One of these two errors has reference to the minimum temperature for Aberdeen (39°·2) which occurred at 4 A.M. of the 11th August, and regarding which the following remark is made in a footnote :—"Doubtful; instrument out of action immediately after 6 A.M." If we turn to the Aberdeen temperature curve of the 11th (Plate xlv.), we see that the instrument was not out of order during the whole of that day; and by examining the curve for the whole month, we see further that the instrument went out of action on no day at 6 A.M., and that on the six occasions on which it was out of order during the month, it is highly probable that in none of the cases did the temperature fall so low as 39°·2.

Tables of errata for 1869 have been published by the Office from time to time, the last one appearing in November 1874. Not one of the numerous errata referring to 1869, as well as those referring to the other years, which have been detected in this examination, has yet appeared in the Tables of errata published by the Office. Furthermore, these Tables of errata are themselves repeatedly in error; thus, the last one, printed on the title-leaf of the Quarterly Weather Report for July—Sept. 1873 contains in the five lines which compose it no fewer than three mistakes; viz., 1874 being twice printed for 1873, and the hour of occurrence of the minimum at Glasgow being curiously printed as 0^h 2 A.M., whereas the month began with the minimum temperature.

As the curves for 1874 are not yet published, there are no means of checking the hourly tabulated readings from the curves. Referring, however, to the regulations laid down for the detection and correction of *small errors*, and to the minute refinement to which the results were to be carried, viz., to the hundredth of a degree, we were led to expect that the tabulated readings would be taken from the curves with an approach to accuracy of at least the tenth of a degree. A slight inspection of the figures of the tabulated readings shows at once that this is not the case, with the single exception of the Observatory at Stonyhurst.

A word will explain our meaning. There being no reason why any one of the ten decimal figures, viz., ·1, ·2, ·3, . . . ·8, ·9, ·0 should occur oftener than another, it is evident that on the mean of, say, a month's observations, the number of times on which a reading of a whole degree occurred would be, approximately, a tenth of the whole number of readings. At Kew, however, out of the whole 744 readings for January 1874, 172 whole degrees were read off from the curves and have been printed in the Tables; in other words, nearly 100 in excess of a due proportion. Next month matters improved at Kew, and only 87 whole-degree readings are given; in March they rose to 127, and fell again in April to 94. In this respect Kew shows the greatest irregularity of all the Observatories, but more especially as regards the tabulations from day to day—showing in this respect a marked contrast with the regular business-like tabulations of Stonyhurst. Summing up all the whole-degree readings at each of the Observatories for the nine months, and comparing the results with a tenth part of all the readings tabulated, we obtain the following results :—At Stonyhurst the number of whole-degrees read off were 16 per cent., *less* than a tenth part of the whole; at the other observatories the numbers are *greater* than a tenth part of the whole, in the following order: Kew, 50 per cent.; Aberdeen, 95 per cent.; Armagh, 112 per cent.; Falmouth, 137 per cent.; Valencia, 147 per cent.; and Glasgow, 148 per cent. Every statistician will know the meaning of these figures, and how completely they destroy the scientific character of the work. It should moreover be kept in mind that 1874 was the sixth year of the tabulation by the Observatories of the readings taken from the curves. The method of tabulation as carried out is too rough for the determination even of the temperature daily "constants"—a statement which will be self-evident from the following hourly mean values for Valencia for the month of July 1874, beginning with 1 A.M. : 57°·7, 57°·5, 57°·3, 57°·2, 57°·1, 57°·6, 58°·7, &c.; the curve for the time from 2 to 5 A.M. cannot be determined from observations in which whole degrees so largely preponderate. Though the instrumental arrangements for the continuous registration of the temperature at the Committee's seven Observatories may well be regarded as a triumph of science, yet the results, as tabulated and published, can scarcely lay claim to a higher value than eye-observations of third-rate observers.

In view of the results of this examination, it is not easy to see how one can make a scientific use of the tabulations, and results deduced therefrom, as made by this department of the Office, until (1) the tracings of the curves from the photographs, (2) the tabulations of the hourly values from the curves, and (3) the monthly and five-day means, have been carefully revised.

It cannot be said that the publications have been issued under a press of work in the Office, seeing that the Quarterly Weather Reports have been published just when the Office has been ready to do it. The last published Report is for the quarter ending September 1873, and the last quarter of 1871 only appeared in November last. Further, at page 66 of the Report for 1873, giving a list of persons in the employment of the Meteorological Committee, we learn that at the time of going to press the number so employed was twenty-four, and the sum expended in the year for their salaries amounted to about 3,727*l.*, to which, if we add 2,722*l.* for expenses at Observatories (Report for 1873, p. 32), it is evident that there can be no reasonable doubt that the staff available for this work is amply sufficient.

There is a question yet remaining to be considered, viz., Are the thermometers at these Observatories in positions which will fairly indicate the march of the temperature of each place through the hours of the day; and, above all, are they so placed as to be comparable with each other? In the Introduction to the Quarterly Weather Report for 1870, pp. iii. to vii., woodcut illustrations are given of the thermometer screens, with their positions and surroundings. No two of these are alike—the only approach to uniformity being Stonyhurst and Glasgow. Two of the Observatories, viz., Valencia and Falmouth, occupy important positions near the sea, and might have yielded valuable results with regard to the influence of the sea on climate, but they have been placed in situations so confined that their temperature observations are of little value con-

sidered as contributions to a scientific inquiry into the climate of these islands.

The Council of the Scottish Meteorological Society, in a report dated 3rd July, 1872, drew attention to the positions of the thermometers, particularly those at Aberdeen which are forty-one feet above the ground and surrounded with buildings; giving it as their opinion that "observations so made were not comparable with each other, nor with other observations."* The publication since, by the Committee, of the hourly readings, enables us to examine the point from the observations themselves. One of the best marked phases of the daily temperature, as well as one of the most important, both for scientific and practical purposes, is the increase which takes place from 9 A.M. to 3 P.M. At Kew the mean increase between these two hours for January and February 1874 was 4°·8, and for June and July 6°·7—the greater increase in the summer months being in accordance with the climatic facts. But at Aberdeen the thermometers indicated between the same hours a mean increase of 3°·7 for January and February, and 1°·8 for June and July; thus, instead of being larger in summer, the recorded difference was only half that recorded in winter. It is needless to remark that these results for Aberdeen cannot represent the temperature of this part of her Majesty's dominions, and that for the supplying of data for temperature "constants" for that part of North Britain, the observations made there are worse than useless. The arrangements for the thermometers at the seven Observatories, both as regards height above the ground, and exposure, call for reorganisation.

In Part I. of the Quarterly Weather Report for 1870 (App. pp. 8–10) appears a valuable Table of the mean monthly readings of the barometer at the Committee's telegraphic stations. If we were sure that the method of annual inspection of these stations is a sound one, the results for Holyhead might suggest an inquiry into the influence of the sea on the state of the barometer. The position of the rain-gauges above the ground at these stations, which varies from five inches to 23 feet (Q. W. Report for 1873, Part III., p. 44), calls also for revision.

In all the Reports issued by the Office it will be observed that no monthly mean temperatures for the telegraphic stations have yet been published by the Committee. With reference to these stations, Mr. Symons, in December 1869, remarked: "Various facts brought under our notice convince us that more remains to be done than has yet been effected, and that in many respects these stations [telegraphic] are unworthy of the nation of which they are to a certain extent representative."† We have no means of knowing how far matters have been rectified. It may therefore be doubted, if the Office were asked to furnish meteorological information for the use of the Registrar-General, whether they possess in their own stations the means of supplying it.

We deeply regret the position we have been forced to assume in reviewing the work of the Meteorological Office, but our duty as public journalists leaves us no choice in drawing attention to the work done in return for the annual grant by Parliament of 10,000*l.*

* Journal Scot. Met. Soc., vol. iii. p. 290.
† *Meteorological Magazine*, vol. iv. p. 177.

ARCTIC GEOGRAPHY AND ETHNOLOGY

A Selection of Papers on Arctic Geography and Ethnology, reprinted and presented to the Arctic Expedition of 1875, by the President, Council, and Fellows of the Royal Geographical Society. (London: John Murray, 1875.)

WHILE in absolute value the Admiralty Arctic Manual must be regarded as considerably superior to the one before us, still the latter contains a great deal of matter interesting in itself and of high value as adding to our knowledge of the Arctic regions. The Geographical Society deserves thanks for the present it has made to the Arctic Expedition, and we have no doubt that the explorers will find the Selection of real service in enabling them to add to our knowledge in the directions pointed out therein. The editing of the work has been well done by Mr. Clements R. Markham.

The papers in the Geographical Society's "Collection" are arranged under the two main divisions of Geography and Ethnology, although under the former there is much that might be more properly classed under the head of Geology. The first series of papers in the geographical section, occupying about one-half of the space allotted to that section, and about one-fourth of the entire volume, is by Dr. Robert Brown. These papers consist mostly of reprints and condensations of papers by Dr. Brown, which have already appeared in various scientific publications. It seems to us that the value of these papers would have been much enhanced had the author carried condensation much further than he has done. Dr. Brown's style is often painfully slipshod; he frequently indulges in a great waste of words with inadequate result, and it would only have been courteous to those for whose behoof this compilation was made to have revised his papers most thoroughly, stating all the facts as briefly and clearly as possible.

It is unnecessary to enter here in detail into the subjects treated of by Dr. Brown, especially as most of the geological facts have recently been given in NATURE in the series of papers by Mr. De Rance (vol. xi. p. 447, *et seq.*) After describing all that is at present known of the Greenland coast-line, both east and west, Dr. Brown gives a brief account of the few journeys that have been attempted into the interior of Greenland. The country has never hitherto been crossed; if judiciously gone about the feat might very possibly be accomplished. He believes Greenland to be "only a circlet of islands separated from one another by deep fjords or straits, and bound together on the landward side by the great ice-covering which overlies the whole interior, and which is pouring its outflow into the sea in the shape of glaciers and icebergs." The general opinion undoubtedly is, as one of the greatest glacial authorities, Mr. James Geikie, puts it, that "the whole interior of the country would appear to be buried underneath a great depth of snow and ice, which levels up the valleys and sweeps over the hills," though Dr. Brown believes there are no mountains of any extent in the interior. The statement of Dr. Rink, in his paper, reprinted here, "On the Discoveries of Dr. E. K. Kane," seems to us, however, to be more philosophical. "The reality is," Dr. Rink says, "that wherever one attempts to proceed up

the fjords of Greenland, the interior appears covered with ice; but there is no reason whatever to assume that this applies to the central part of the country, in which one, on the contrary, just as well may assume that there are high mountain chains, which protrude partly from the ice." Dr. Rink, moreover, thinks the "ice-fjords point out probably the rivers of the original land, now buried under ice." At present any statements with regard to the interior condition of Greenland must be at best conjectural, though all we know seems to point to its being one sheet of glacial ice, the main flow of the glacier being to the west rather than to the east.

The remainder of the geographical section is occupied by some very valuable papers which the Society have done well to reprint and put in the hands of the members of the Expedition. The paper "On the best means of reaching the Pole," by Admiral Baron von Wrangell, is interesting as being the first proposal to attempt to reach the Pole by the route of Smith's Sound. The paper, moreover, gives some valuable hints as to the method which ought to be adopted in attempting an exploration by this route, and coming as they do from one who has had so great experience in Arctic exploration, they ought to be received with great respect. The paper by Dr. Rink, who may safely be entitled "one of the most eminent living authorities" on many scientific subjects connected with Greenland, on the discoveries of Dr. Kane, we have already alluded to. While admitting the valuable contributions made by Dr. Kane to our knowledge of the geography of the Smith Sound route, Dr. Rink justly criticises the scientific theories broached by Dr. Kane as to the interior of Greenland, the "open Polar Sea," the connection between the Greenland and American coasts, and other points. Dr. Kane's theories are shown to have been based on very insufficient data, and subsequent exploration has only served to prove the justness of Dr. Rink's criticisms.

One of the most careful papers in this section is by Admiral E. Irminger, of the Danish Navy, on "The Arctic Current around Greenland." This paper is based on a thorough examination of the log-books of a large number of Danish ships sailing between Greenland and Denmark. The now generally accepted conclusion he reaches is that the current from the ocean around Spitzbergen, which carries so considerable masses of ice, after it has passed along the east coast of Greenland, turns westward and northward around Cape Farewell, *without detaching any branch* to the south-westward, directly towards the banks of Newfoundland. The current afterwards runs northward along the S.W. coast of Greenland, until about lat. 64° N., and at times even as far up as 67°. Afterwards turning westwards, it unites with the current coming from Baffin's and Hudson's Bays, running to the southward on the western side of Davis Strait, along the coast of Labrador, thus increasing the enormous quantity of ice that is poured into the Atlantic Ocean.

The concluding series of papersin the geographical section is by Admiral Collinson. "The full results of that distinguished officer's remarkable Arctic voyage," to quote the words of the preface, "have never been given to the public; and both the Fellows of the Society and the officers of the Arctic Expedition are to be congratulated on having elicited so valuable an instalment. Admiral Collinson gives his notes on the state of the ice, and on indications of open water, from the mouth of the Siberian river Kolyma, along the shores of Arctic America, to Bellot Strait. He also furnishes a narrative of all the expeditions that have explored the shores of Arctic America, from Point Barrow to the Mackenzie River, and from the Mackenzie to the Back River, including his own voyage, and concludes with some general observations on the ice." The contribution made by Admiral Collinson is really an elaborate one, and must have cost its author much trouble. It affords insight into a variety of points connected with Arctic navigation, but more especially on the tides, the nature of the ice, the set and rate of the currents in Behring Strait, and to the east and west of that along the coasts of America and Asia.

"On the Asiatic side we have indisputable records of open water continuously met with during the period of lowest temperature for a distance of upwards of 1,000 miles. On the opposite shore the ice is driven frequently during the winter by the force of the wind from the coast at Point Barrow, but along the American continent to the eastward the ice, as far as we are capable of judging from one winter's experience, it remains quiet and immovable. Hence comes the question, Does the effect of the Pacific current lose itself in the expanse of the Polar Sea, or does it take an easterly trend? So far as experience guides us, the positions reached by the *Enterprise* in 1850 prove the existence of a loose pack 100 miles to the north-east of Point Barrow; beyond this, until we come to the records given by Sir R. M'Clure, nothing is known, but we have undoubted testimony that the pressure on the north face of Banks Land comes from the westward: and here in this strait, between Melville Island and Banks Land, occurs one of those dead locks in the motion of the ice that are remarkably instructive. . . . . So far as can be gathered from the accounts given, it may, I think, be assumed that the pack is looser, and open spaces of water are more frequent to the north than they are to the south of the Parry Group. . . . Though the Pacific current is in a great measure turned aside from the face of the American continent by the abrupt change in the direction of the coast at Point Barrow, the testimony of all navigators is conclusive that it is felt, and that an easterly set pervades to a greater extent than a westerly one, and that this set is more noticeable to the east of the Mackenzie."

All the papers in the second part of the Selection, that on Ethnology, are valuable. Mr C. R. Markham contributes four papers, the first "On the Origin and Migration of the Greenland Eskimo," being one of the most interesting and instructive in the whole book. Mr. Markham has evidently given the subject careful study, and his hypotheses seem to us to be on the whole sound. For three centuries after the Norse began to settle in Greenland in the end of the tenth century, Mr. Markham believes that no indigenous race was seen in the land; that all at once, about the middle of the fourteenth century, a horde of Skrœllings appeared in the extreme northern frontier settlements of Greenland, and seem rapidly to have stamped out the Norse colonists. Whether this was so or not, there seem to us great probability in the theory of the migration of the Greenland Esquimaux advanced by Mr. Markham. During the centuries preceding the first reported appearance of the Esquimaux in Greenland, the commotions in Central Asia, under Tugrul Beg, Jenghiz Khan, and other leaders, were the means of sending forth swarms of Turks and

Mongols in all directions. The pressure caused by these invading waves on the tribes of Northern Siberia drove them still further to the north. Horde succeeding horde increased the pressure, until at last the Omoki, the Chelaki, the Onkilon, and other aboriginal tribes, were driven quite out of the country, and have long ago disappeared entirely, leaving only traditions of their existence and remains here and there of their *yourts* or dwellings.

Mr. Markham thinks that here we have probably the commencement of the exodus of the Greenland Esquimaux, which spread over a period of one or two centuries. He believes they must have made their way from Cape Chelagskoi to the Parry group, probably over a chain of islands. Still keeping northwards, by Banks Island, Melville Island, Bathurst Island, North Somerset and Devon, Jones' Sound, Carey Islands, on all which undoubted traces of Esquimaux have been found, but where the conditions are not favourable to permanent settlement, the Asiatic emigrants made their way to Smith Sound, which they crossed in parties during the fourteenth, fifteenth, and sixteenth centuries. Some established their hunting grounds between the Humboldt and Melville Bay glaciers, and became the ancestors of that very curious and interesting race of men the Arctic Highlanders. Here the vegetation, the constant open water, and other conditions rendered a permanent settlement possible. Mr. Markham believes that some of these immigrants proceeded southwards and peopled South Greenland; not only so, but that parties also wandered still further north than the Humboldt Glacier, and that it is not improbable that our new Expedition may find groups of Esquimaux up to the very Pole itself. *Nous verrons.* Meantime, we repeat, Mr. Markham's theory seems to us a plausible one, and to answer all the requirements of an immigration into Greenland of a people such as are the Esquimaux. Dr. Rink, however, in a paper on the Descent of the Esquimaux, is inclined to believe them the last wave of an aboriginal American population driven from the interior by the pressure of tribes behind them. This may have been so, and the people in the north-east of Siberia, so strongly resembling the Esquimaux in language, *physique*, and customs, may have been American emigrants; but the reverse hypothesis appears to us much more probable.

Another extremely interesting paper by Mr. Markham, on the Arctic Highlanders, contains many details concerning the country, the character, the manners, customs, language, &c., of this curious people. Mr. Markham remarks upon what has been noticed by several explorers, the wonderful talent of this people for topography, and reproduces a most careful and accurate chart of the Greenland Coast from Cape York to Smith Channel, drawn by the Greenlander Erasmus York. These two papers are well worthy the attention, not only of the explorers for whom they have been compiled, but of all interested in Greenland ethnography. Mr. Markham's other contributions are a sketch of the grammar of the Esquimaux language, with copious vocabularies, and a long list of the names of all places on the coast of Greenland from lat. 65° 15′ N. on the eastern side, round Cape Farewell, to the entrance of Smith Sound. Along with this most laborious list is a chart of the south coast of Greenland from the Danish Admiralty Survey, with Mr. R. H. Major's adaptation of the ancient sites in the East Bygd, of the old Greenland colony.

Dr. Rink's paper on the Descent of the Esquimaux we have already referred to, and we have space merely to allude to the admirable and interesting and almost exhaustive paper on the Western Esquimaux, by Dr. John Simpson, of H.M.S. *Plover*, reprinted from the Parliamentary Arctic Papers of 1855. The volume concludes with the Report of the Anthropological Institute, and an appendix containing ethnological questions for explorers, drawn up by various eminent members of that Society,

Altogether, from the brief glance we have been able to take at this "Selection," it will be seen that it contains much of really intrinsic value, for having put which into so accessible a form, all who take an interest in Arctic matters will be grateful to the Geographical Society. It will, we are sure, moreover, be a welcome addition to the equipment of the members of the Arctic Expedition; and if carefully studied, as no doubt it will be, it cannot but suggest many lines of inquiry that are likely to lead to very valuable results.

VOGEL'S "LIGHT AND PHOTOGRAPHY"

The Chemistry of Light and Photography in its Application to Art, Science, and Industry. By Dr. Hermann Vogel, Professor in the Royal Industrial Academy of Berlin. With 100 Illustrations. (London: Henry S. King and Co., 1875.)

TO one acquainted with the very small amount of scientific literature yearly produced by the professional and amateur devotees of photography the name of Dr. Hermann Vogel is one associated most intimately with the scientific progress of the art. Dr. Vogel has lately attracted somewhat wider notice by his researches on the effects of coloured media in modifying the action of monochromatic light on photographic films, and the research is likely to lead to important results in the department of spectrum photography.

It was therefore in anticipation of at last finding a scientific manual of photography that we took up the translation of Dr. Vogel's work at present under review, hoping that Messrs. King and Co. had been the means of bringing a good book before the English scientific and photographic world. Unfortunately the whole experiment has been spoiled by the simple device of placing the translation in the hands of a person who is totally unacquainted with either chemistry or photography, and who is also not given to expressing himself in clear English.

On p. 4 we are informed that argentic chloride can be prepared by "directing chloric gas upon metallic silver;" and on p. 19 that "by employing *iodide of bromium* . . . the process of exposure was made a matter of seconds." On p. 35, "Archer coated glass plates with collodion in which salts of iodide had been dissolved;" and the same page contains this typical specimen of English: "After 1853 paper pictures on collodion negatives came more and more into vogue, the demands for daguerreotypes fell off and soon vanished altogether, and were produced only here and there in America;" while on p. 36 we are told that there are in Berlin "ten photographic album manufactories, to satisfy the demand, from whence they are exported to all parts of the world."

The following explanation of the reaction occurring during the immersion of the collodionised plate in the nitrate bath is given at p. 41: "The salts of iodine and of bromine that exist in the collodion film change their *properties* with nitrate of silver and give birth to iodide and bromide of silver and to *nitric acid salts*." The italics are our own. On p. 70 a footnote is added to explain that "1 gramme = the 1,000th part of a cubic metre, about nine solid feet of water at the ordinary average temperature."

Under the head of "Operation of Light on the Elements," which commences on p. 107, we find that chlorine is "a greenish strong-smelling gas developed from chloride of lime," that bromine "is an unpleasantly smelling substance of a fluid nature," and that iodine is "a black substance also of a fluid nature and used for friction." "Sulphur unites with oxygen and produces the pungent strong-smelling sulphuric acid;" "chloride and bromide gas show a peculiar relation to light even in their combinations;" and lastly, iodine again appears as a "solid body appearing in the form of shining black crystals, and emitting, when heated, a wonderful violet vapour."

Under the head of "Chemical Effects of Light on Salts of Silver," chloride of silver forms a "cheesy" precipitate; chloride, bromide, and iodide of silver are "very tenacious bodies;" when chloride of silver is exposed to light, the "chloride is liberated, and disappears as a greenish gas, which, from its abundance as well as its odour, can be perceived to be chloride of silver." "Green vitriol is greatly attracted by oxygen, and taking it up readily, passes into sulphate of iron."

On p. 118 we have the following lucid description of the toning process:—"The positive prints are subjected to a further treatment styled the colouring process. To this end it is plunged in a very diluted solution of gold. This solute (*sic*) contains chloride of gold. Metal silver has more affinity with chlorine than gold; hence it combines with the chlorine, forming chloride of silver, while the gold is precipitated. It becomes separated in the shape of a blue colour, adhering to the outlines of the picture, and this blue, mixed with the brown of the picture, gives a pleasant tone which does not change in the fixing-bath, that is, in hyposulphite of soda." The latter body is, by the way, alluded to indifferently as hyposulphite of soda, "fixing sodium," and "fixing natrium."

In photographic apparatus the translator is equally at sea. A dark slide is continually spoken of as a "cassette," and a printing frame as a "copper frame." The technical names of the processes are also as a rule incorrect.

We have no patience to devote more time to this wretched translation, which is only passable in portions of the part on the physics of some of the photographic processes.

While Dr. Vogel is held to blame for a prolixity and discursiveness which, together with the childishly elementary character of much of the work, render it very dull, the editors of the "International Scientific Series" must be held responsible for still further reducing the value of the work by employing a translator ignorant of the subject.

R. J. F.

OUR BOOK SHELF

Ornithological Miscellany. By George Dawson Rowley, M.A., F.Z.S., Member of the British Ornithologists' Union. Part I., No. I. January 1875. (London: Trübner and Co.)

THE first number of Mr. Rowley's "Ornithological Miscellany" is devoted to the illustration of some of the rarer birds of New Zealand which have lately come into his collection. The most interesting of these is perhaps the large spotted Apteryx discovered by Mr. Potts in 1873, and named after Dr. Haast, of which, we believe, Mr. Rowley's specimens are the first that have reached this country. Figures of and remarks on the other known species of Kiwi are also given, so that we have altogether a nearly complete account of what has yet been ascertained respecting the external form and habits of these singular birds. Mr. Rowley passes on to discuss the structure of the feathers of the Struthious birds, of which he also gives us some admirable illustrations. A glance at these will serve to show how very far removed in many essential points is the genus *Apteryx* from the Cassowaries and others of the order *Struthiones*, with which it is commonly associated. Finally, Mr. Rowley gives us an account of a white variety of one of the Nestor parrots of New Zealand, which, as all birds are subject to the occasional influences that produce albinism, is not, perhaps, after all, of special interest; but Mr. Keuleman's well-drawn figure of this bird will be appreciated by all ornithologists.

Such are the contents of Mr. Rowley's first number. In regretting that he does not know when the next will appear, or what it will contain, we fully sympathise with the author. But if Mr. Rowley can produce from his cabinets a similar series of rarities to figure, and find an equally good artist to draw them, we are sure that his second and following numbers will meet with equal appreciation from every lover of natural history.

On Numerals in American Indian Languages, and the Indian Mode of Counting. By J. Hammond Trumbull, LL.D. (Hartford, Connecticut, 1875.)

FROM a careful examination of the numerals in various North American languages, Dr. Trumbull adds some interesting evidence to that already available as to the native development of arithmetic among uncultured races. The derivation of numeral-words from the names of the fingers habitually used in counting numbers is well shown in Hudson's Bay; Esquimaux *eerkitkoka* = "little finger" being used as a numeral for 10, while *mikkeelukkamoot* = "fourth finger" signifies 9. Other materialistic sources of numeral-words are apparent in the Micmac language, where *tabu* = "equal" has become a numeral for 2 (like our own word "pair," from Latin *par*), while *tchicht*, which means 3, may have originally meant "more" or "again," and been used to distinguish the plural as beyond the mere dual (compare Latin *trans* and *tres*). As in the civilised Old World languages with which philologists especially occupy themselves, the numerals have for the most part lost the traces of their original significance, their development, a not unimportant part of the intellectual development of mankind, has to be learnt from investigations like the present into savage or barbarian tongues.

E. B. T.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

British Rainfall, 1874

I AM much obliged by your favourable mention (NATURE, vol. xii. p. 76) of my annual volume, and am very glad to find that it concludes with a suggestion, because, to quote from p. 138 of

the work under notice, "We always receive with pleasure suggestions for the improvement of this publication, and within reasonable limits never allow either trouble or cost to prevent the adoption of all which in any way commend themselves to our judgment."

Your suggestion is as follows :—

"The publication of the monthly as well as the annual amounts of rain for the whole of the 1,700 stations is very desirable, and it is hoped that in an early issue of the 'British Rainfall' it will be done."

I shall be glad if you will allow me to supplement the data which were before you when the above paragraph was written by some other facts, and to learn from your pages whether or not this fuller information induces any modification of your views.

As I (whether fortunately or unfortunately I need not say) have to pay my own printer's bills, I always keep them as low as possible ; hence, the publication being an annual one, statements made in one volume are rarely repeated in the next. Therefore, probably, your reviewer was not aware of the principles upon which the tables of monthly rainfall (pp. 140–145) are compiled, viz., to give one station in every county in the British Isles, and two in a few of the larger ones, such as York, Inverness, and Ross. I may add *en passant* that these tables give the monthly fall at 108 stations, while the Registrar-General of England is satisfied with forty-four, and of Scotland with fifty-five ; so that my table exceeds both together. That, however, is of little moment. [For your own information, I enclose a map with these 108 stations plotted.]

In the next place, I must refer to "British Rainfall, 1871," pp. 135–138, where the question of publishing additional monthly returns is discussed at length, and the method of computing the monthly fall from the percentage tables (which are given every year) is explained and illustrated by a completely worked-out example.

To this let me add that returns from 150 other stations are published monthly in my *Meteorological Magazine*, and that up to the present time another very large series (143) has been printed biennially in the Reports of the British Association.

If it is the opinion of yourself and of others competent to judge that still more is necessary, more shall be done ; but it must be borne in mind that the accurate (and without accuracy figures are worse than useless) printing of 20,400 values involves a great expenditure both of time and of money. I do not quite know whence either the one or the other is to be obtained.

G. J. SYMONS

[It was just because of the inadequacy of one station in each county of the British Isles, and two in the larger counties, to represent the rainfall, even though these be supplemented by Mr. Glaisher's forty-four stations, the Scottish Meteorological Society's two hundred odd, and by Mr. Symons himself in his Magazine and in the British Association Reports, that we stated it to be very desirable that the monthly as well as the annual amounts of rain for the whole of the 1,700 stations were published. The method of computing the monthly fall from the percentage tables referred to in "British Rainfall, 1871," pp. 135-138, does not supply what is desiderated. It is the capriciousness of the distribution of the rainfall and its important bearings on many practical questions which render so desirable a knowledge of the actual monthly amounts in particular localities. Since what is desired would be an invaluable contribution to British Meteorology, we earnestly hope that Mr. Symons will be induced to supply it, and that in that case he will receive substantial support in carrying on a work so important.]

Equilibrium of Temperature in a Vertical Column of Gas

I OBSERVE that Mr. R. C. Nichols, in his letter to NATURE (vol. xii. p. 67), admits that the mean energy of molecules "*may*" remain the same at all points of a vertical column. It is not difficult to show that it *must* do so if the velocities are distributed among the molecules according to the exponential law.

As I have never seen any direct proof of this in English I extract the following from Boltzmann.

In order not to take up too much of your space, we will take the simplest case, and suppose the molecules to be equal elastic spheres, moving in a vertical tube with elastic base and sides. Let them be acted upon by vertical forces, the potential of which at height x above the base is $f(x)$. Assume first that no encounters take place between the molecules, and let the number of molecules at the base, the energy of whose vertical velocity is v^2, be $Ce^{-\frac{v^2}{k^2}}$ where C and k are constants. For each molecule the sum of the potential and kinetic energies is constant.

And as the horizontal velocities are constant, it follows that for each molecule the sum of the potential energy and the energy of vertical velocity is constant. That is, the energy of vertical velocity is diminished by $f(x)$ in the ascent from the base to x.

Therefore the molecules which at height x have u^2 for energy of vertical velocity are the same identical molecules which at the base have $u^2 + f(x)$ for energy of vertical velocity.

Their number is therefore $Ce^{-\frac{u^2+f(x)}{k^2}}$ that is $e^{-\frac{f(x)}{k^2}} Ce^{-\frac{u^2}{k^2}}$.

Therefore the number of each class at x is the same as the number of the same class at the base multiplied by the factor $e^{-\frac{f(x)}{k^2}}$

Evidently the mean energy is the same at all points of the tube, and the density only varies, and is represented by $e^{-\frac{f(x)}{k^2}}$.

Again, still precluding encounters, let the velocities of the molecules in each of two horizontal directions at right angles to each other be distributed according to the same law as the vertical. And further, let the chance of a molecule having given horizontal velocity in either direction be independent of its velocity in the other horizontal direction or in the vertical. The same distribution and independence will be maintained throughout the tube. And we see that force has no tendency to disturb it.

Maxwell has shown that among such molecules as we have supposed encounters have no tendency to disturb the given distribution, which must therefore remain undisturbed though force and encounters both be present.

S. H. BURBURY

Primine and Secundine

WILL you allow me to avail myself of your pages as a means of pointing out to those who have purchased the English edition of "Sachs's Text-book of Botany" an unfortunate error which Prof. Oliver has been so good as to point out to me?

On p. 501 the inner coat of the ovule is identified with the "Primine" of Mirbel, and the outer with the "Secundine." The application of these terms is exactly inverted. The confusion easily arises from the fact that the secundine is developed *first* and the primine *second*. Mirbel, however, ignorant of, or disregarding that fact, numbered his structures from without inwards. The outer coat he termed the primine, the inner the secundine, the nucleus the tercine, and so on to quartine and quintine.

Except for the sake of accuracy the matter is of no essential consequence. Those who study the coats of ovules may well be indifferent to Mirbel's perplexing terms. But in these days, when students are expected for examination purposes to know about the names of things rather than about things themselves, it might lead to deplorable consequences, of which I hasten to relieve myself of the responsibility.

W. T. THISELTON DYER

American Indian Weapons

IN Col. Lane Fox's Catalogue of his Anthropological Collection he quotes Schoolcraft as saying, "There is no instance amongst the North American Indians in which the war-club employed by them is made of a straight piece, or has not a curved head." I send you a drawing (Fig. 1) of a club in common use among the Numas, or Indians of the Great Interior Basin, embracing Shoshones, Utes, Pueblos, &c., which will no doubt interest Col. Fox and others, not only on account of its extreme simplicity of form, but also of its method of use. It might be called appropriately a "face-masker," being grasped with the bulb next to the little finger, and thrust into the countenance of the foe. Major Powell sent a number of these to the Smithsonian Institution. They are of one piece of wood, generally mezquite, either very rude or quite smoothly polished, and are worn attached to the wrist by a leather thong. They vary in length from eight inches to fourteen. These same tribes use a simpler "slung shot" than the one described in Col. Fox's Cata-

logue, p. 65 (Fig. 2), the stone ball hanging loosely from the handle in a bag of buckskin. The Moquis of this same region use the boomerang; two of these (Fig. 3) are in the Smithsonian Institution. I am not sure that it returns to the hand of the thrower.

On page 91 of Col. Fox's Catalogue he says: "In California and the greater part of the North American Continent the arrows are constructed either in a single piece or with a bone foreshaft; but in no case have I come across a foreshaft of hard wood." Among the Numas of the Great Basin, reed arrows with hard wood foreshaft are very common (Fig. 4). In Northern California two kinds of arrows have hard wood foreshaft, those with and those without stone points (Figs. 5 and 6). The stripes on the feather end are rancheria marks, and the foreshaft is moveable.

OTIS T. MASON

Washington, D.C., U.S., May 19

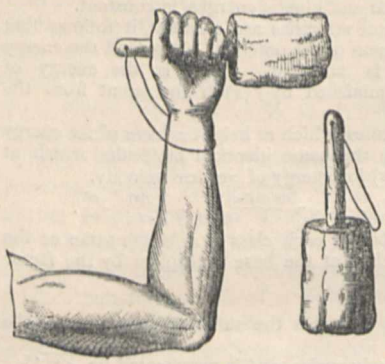

Fig. 1.—Pai-Ute War Club, for thrusting by a backhanded blow into the face of an enemy. Made from the wood of the Mezquite bean.

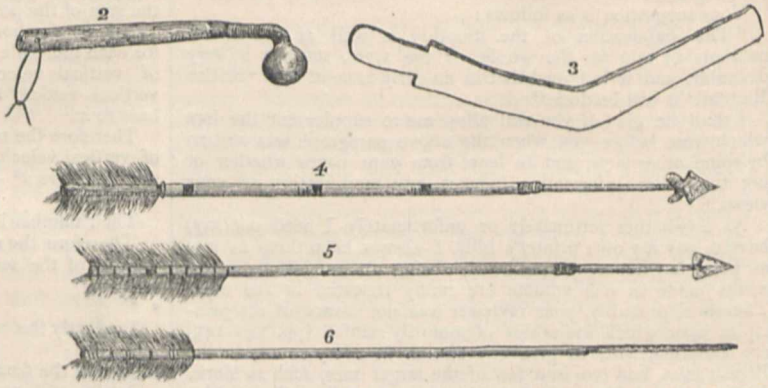

Fig. 2.—Pai-Ute War Club. Fig. 3.—Moquis Boomerang. Fig. 4.—Numa [Reed Arrow, with hard wood foreshaft. Fig. 5.—Klamath River Pointed Arrow; soft wood shaft, hard wood foreshaft. Fig. 6.—Klamath River Arrow, without point; soft wood shaft, hard wood foreshaft sharpened.

Primroses and Cowslips

MR. FORDHAM (NATURE, vol. xii. p. 87) is quite right in conjecturing that it may be without foundation he has thought that primroses are not found in districts in which cowslips are common, and *vice versâ*. In the north-east of Staffordshire, for miles round Denstone College, early in the spring, nearly all the hedges and many of the fields are covered with primroses. Later on cowslips abound; I might add that oxlips are also far from being rare.

I have watched closely, but have never found a trace of any destruction of the flower by birds. This, perhaps, may be accounted for by the fact that this being a pasture country, the sparrow, finding no grain, is a *rara avis* about here. I have noticed in Lord Bagot's wood, some twelve miles from here, where sparrows as well as many other birds are found in great numbers, that the primroses nearly always present a very ragged appearance.

D. EDWARDES

Denstone College, Uttoxeter

I COULD name half a dozen spots to the north of London (Mill Hill) where cowslips and primroses have abounded together in the same meadow, to my own knowledge, for the past twenty years. For at least five years I can say that neither the primroses nor cowslips were attacked by birds, though the crocuses were cut up by them more or less every season in the same locality.

R. A. N.

THE VISITATIONS OF GREENWICH AND EDINBURGH OBSERVATORIES

WE have before us the Annual Reports of the Astronomers Royal for England and Scotland, to their respective Boards of Visitors. The Report of Sir G. B. Airy consists mainly of the usual statements under the various heads of the state of the buildings and instruments, the constitution of the staff, and the amount of work done. In all these respects the Observatory seems to be in a satisfactory condition. One important change in the staff during the past year has been the resignation of Mr. Glaisher, who has for so many years been connected with the Observatory, and which has rendered necessary a readjustment of the duties of the various observers.

Under the head of "Chronometers, Time-signals," &c., the Astronomer Royal refers to the supplemental mechanism which he himself has introduced into some chronometers in order to correct the perceptible defect of thermal compensation which occurs in nearly every case, even in the best chronometers. "There is," he states, "great difficulty in correcting the residual fault, not only because an inconceivably small movement of the weight on the balance-curve is required, but also because it endangers the equilibrium of the balance. To remedy this I have introduced small supplementary weights carried by means of a supplementary bar (rotating with stiff friction in the balance-staff), at whose ends are very light springs carrying the supplementary weights, and constantly pressing them to the interior of the balance-curve. When the supplementary bar is so turned that the supplementary weights are near the end of the balance-curve, the compensation is large; when they are near the root of the balance-curve, it is small. The movement from one state to the other is so simple that probably an assistant of the Observatory will be able to manage it, and it does not interfere with equilibrium. This arrangement has received the approval of some able chronometer-makers, and may perhaps with advantage be adopted generally."

The various time-signals and clocks connected with the Observatory have been worked with praiseworthy regularity and accuracy; the Westminster clock has been so well regulated, under check of automatic report to the Observatory, that in 83 per cent. of the days of the year its error is below one second. Proposals have been made for galvanic determination of the longitude of the Dublin Observatory, and the operation is delayed only for convenience in the arrangements to be made at Dublin. With the aid of a grant from the Treasury three computers are now steadily at work on the Astronomer Royal's New Lunar Theory.

The most novel and interesting part of Sir George Airy's Report is his concluding "General Remarks," in which

he takes a rapid glance over the changes in the Observatory in the forty years during which he has been at its head. "The Observatory was expressly built," he states, "for the aid of astronomy and navigation, for promoting methods of determining longitude at sea, and (as the circumstances that led to its foundation show) more especially for determination of the moon's motions. All these imply, as their first step, the formation of accurate catalogues of stars, and the determination of the fundamental elements of the solar system. These objects have been steadily pursued from the foundation of the Observatory; in one way, by Flamsteed; in another way, by Halley, and by Bradley in the earlier part of his career; in a third form, by Bradley in his later years, by Maskelyne (who contributed most powerfully both to lunar and to chronometric nautical astronomy), and for a time by Pond; then with improved instruments by Pond, and by myself for some years; and, subsequently, with the instruments now in use. It has been invariably my own intention to maintain the principles of the long-established system in perfect integrity; varying the instruments, the modes of employing them, and the modes of utilising the observations by calculation and publication, as the progress of science might seem to require.

"While instruments of the same class, but of increased power, have been substituted for those which I found here, three novel constructions have been introduced; the lunar altazimuth, the reflex-zenith-tube, and the chronograph; and, for a special investigation, the water-telescope (now dismounted). I omit mention of auxiliary instruments. To utilise the observations, the numerical reductions for each current year have always been maintained in the most perfect state that I could devise. From these, elaborate star-catalogues (now in frequent demand) have been formed from time to time. And, for connecting the observations of the moveable bodies of our system in a complete and homogeneous series, beginning at 1750, first the planetary observations, and secondly the lunar observations of my predecessors have been reduced, and orbital elements have been corrected. The lunar reductions are probably the greatest single work ever undertaken in astronomy. This portion of our labours may be considered as applying to the combined subjects of astronomy and navigation. But there are also, peculiar to astronomy, the photoheliography and spectroscopy lately introduced. And, peculiar to navigation and related subjects, there are the investigation of the laws of magnetic disturbance in iron ships, and the correction of the compass by methods now used in the commercial navies through the world; the maintenance of magnetic observations; the incessant attention to chronometers; the extensive dissemination of accurate time-signals; and the daily dropping of a time-ball at Deal.

"The subject of meteorology, which has been followed for many years, is scarcely connected with the two great heads of astronomy and navigation, and hardly deserves the name of a science. It is, however, in great popular request. Mechanical self-registration of some meteorological phenomena was introduced by me shortly after the commencement of my residence. Since that time the practical arts of photography and galvanic communication were invented, and they were quickly made available in many of our operations. In this increase of occupations, the annual expenses of the Observatory have increased, but in a much lower proportion than the work done.

"Experiments have been made, bearing on cosmical physics, by Maskelyne for the attraction of Schehallien, and by myself for the vibrations of pendulums in mines. Preparations have been made for observations of eclipses and of the Transit of Venus. Assistance has been rendered to the Government in training officers for such services as tracing national boundaries, &c., and in reference to National Standards. The Lunar Theory, though most intimately connected with the highest interests of astronomy, scarcely presents itself to me as a work of the Observatory.

"Turning now from the past to the future, I see little in which I could suggest any change. If it should ever be necessary to make any reduction, I should propose to withdraw meteorology, photoheliography, and spectroscopy; not as unimportant in themselves, or as ill-fitted to the discipline of the Observatory, but as the least connected with the fundamental idea of our establishment. In the nature of addition, I will indicate one practical point. I much desire to see the system of time-signals extended, by clocks or daily signals, to various parts of our great cities and our dockyards, and above all by hourly signals on the Start Point, which I believe would be the greatest of all benefits to nautical chronometry. Should any extension of our scientific work ever be contemplated, I would remark that the Observatory is not the place for new physical investigations. It is well adapted for following out any which, originating with private investigators, have been reduced to laws susceptible of verification by daily observation. The National Observatory will, I trust, always remain on the site where it was first planted, and which early acquired the name of 'Flamsteed Hill.' There are some inconveniences in the position, arising principally from the limited extent of the hill, but they are, in my opinion, very far overbalanced by its advantages."

We quite agree with the Astronomer Royal that a strictly Astronomical Observatory is not the place for such observations as those mentioned in the conclusion of his Report; it would be much, both to the advantage of astronomy and of the important branches of science referred to, that the latter should have one or more Government establishments allotted solely to their investigation, establishments quite distinct from and independent of the Greenwich Observatory.

The Report of the Astronomer Royal for Scotland is a little more fervid than the one just mentioned, or indeed than official documents generally are. The funds of the northern establishment continue to be extremely inadequate to its requirements, and it reflects great credit on Prof. Piazzi Smyth that he is able, year after year, to show such a satisfactory output of work.

In reference to Zodiacal Light Spectroscopy, the Report, referring to the results obtained by the expedition, at Prof. Smyth's own expense, to Sicily in 1872, states that he has another research of the same kind in progress, which will require him, for its completion, to visit successively with the same instruments the shores of the Arctic Ocean and a tropical mountain-peak. We hope Government will provide him with the very small sum necessary to carry out this important work. Prof. Smyth is also carrying out, under great difficulties, observations in Auroral Spectroscopy, for which he is very favourably located; but again he is hampered by want of the necessary instruments. No doubt Mr. Cross's recent unexpected official visit, if it meant anything at all, will lead to speedy attention being paid to the very reasonable demands of the Scottish Astronomer Royal.

An appendix to the Report contains some documents intended to show the real position of the Observatory and of its chief, and his relation to the professorship of astronomy in Edinburgh University which he holds. It seems the University Council wish to make out that 300*l.* of his not excessive salary he receives solely as occupant of that chair, and must resign this sum with the chair. Altogether it seems to us the duty of Government to make a speedy and thorough inquiry into the position of the Northern Observatory, and put it into a state of such complete efficiency that there will be no further room for complaints. We regret to see that the new equatorial is still in the contractor's hands.

THE PROGRESS OF THE TELEGRAPH *

VII.

IN 1843 Alexander Bain made certain important improvements in the recording and transmitting instrument shown in Fig. 28, in which two semicircular magnets B B′, with similar poles facing, fixed to a brass bar, move through the centres of two coils, A A′, the index-hand pointing to I or V according to the direction of the current. This was controlled by the metallic contacts N N′ N″ N‴ opening or closing the battery and line circuits according to the position of the handle F. The connection and direction of the current through the instrument from the battery D is indicated by the arrows, the connection R being that of the line wire, and S that of the earth circuit.

This patent and certain others that will be brought under notice gave rise to expensive litigation in the early history of the telegraph. In 1846 John Nott produced his letter-recording telegraph, which, in conjunction with Mr. Alexander Bain's inventions, was carried into the law courts on a question of infringement of the Cooke and Wheatstone patent rights; but for reasons already given regarding patent law, the opposition was unsuccessful on the part of the Electric Telegraph Company.

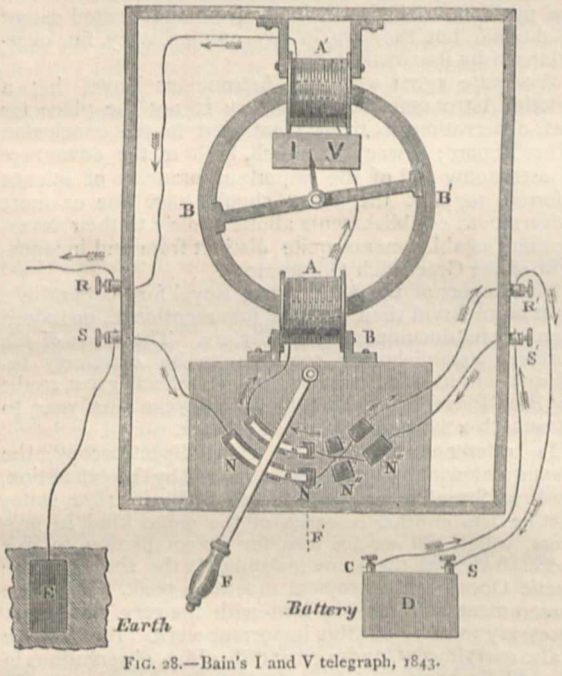

FIG. 28.—Bain's I and V telegraph, 1843.

Nott's apparatus is shown in external and internal elevation in Figs. 29 and 30. It consisted of a dial showing the letters of the alphabet and numerals repeated four times in the circumference of the circle. The respective letters or numerals were indicated by the step-by-step motion of a revolving pointer or index-hand. The motion of this pointer was controlled by successive make-and-break contacts with the battery by means of a finger-key dipping into a mercury cell, *b*. The index-pointer was driven round by a "clawker-and-driver" action in connection with the toothed wheel *c*, the propelling power being derived from the attractive and repellant action of two horseshoe electro-magnets, *a*, *d*, acting upon soft iron armatures in connection with the "clawker-and-driver" motion. The electro-magnet *b* governed the alarum or call-signal. Either the speaking or alarum portion of the telegraph was brought into action by the position of the contact drums, *f*, *f*, which regulated the direction of the battery current through the electro-magnets, by means of the index shown in the external view (Fig. 29) being moved to the one side or the other.

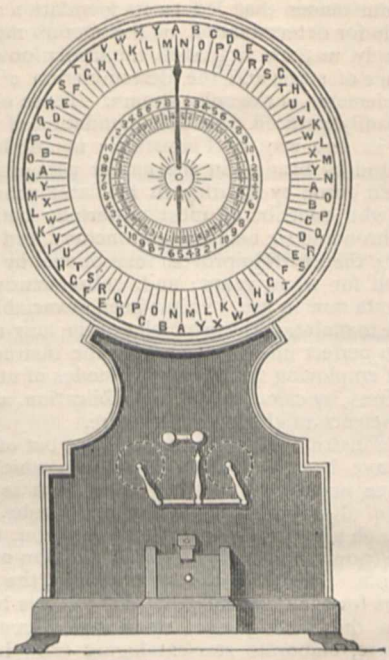

FIG. 29.—Nott and Gamble's patent, 1846. External view.

In 1846 Highton's gold leaf indicator was brought under notice, and an important automatic chemical printer-recording high-speed telegraph, by Alexander Bain, which has been the germ of several of the applications in the modern high-speed automatic arrangements (Fig. 25). In this chemical printer, a paper strip, perforated with holes in symbolic groups to represent the several words of the message, was employed to regulate the automatic sequences of the current through the line. This paper ribbon was passed over a metal drum in circuit with the line wire, and a fine metal style in connection with one pole of the battery

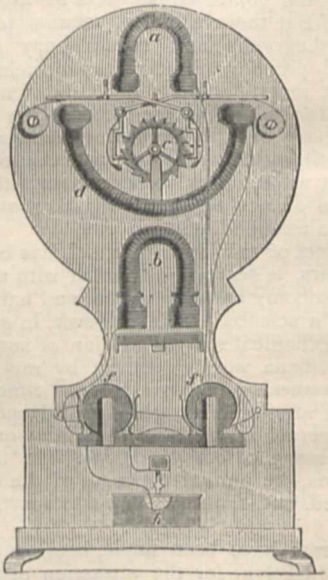

FIG. 30.—Nott and Gamble's patent, 1846. Internal arrangement.

* Continued from p. 72.

(the other pole being to earth) pressed upon the paper ribbon. As the ribbon was drawn forward whenever a perforation passed the point of the style, metallic contact between the battery and line wire was momentarily made, and a current transmitted to the distant station, the duration of the current being regulated by the length of the perforation in the paper—thus giving the dot and dash code. The message at the distant station was printed by chemical decomposition. A ribbon of paper, prepared by immersion in a solution of sulphuric acid and prussiate of potass, was drawn over a metal cylinder in communication with the earth, and pressing upon this chemically prepared paper was a metal style in connection with the line wire. When, therefore, a current is received by reason of the metal style at the transmitting station passing a hole and joining battery to line, the chemical preparation of the receiving ribbon is momentarily decomposed by the action of this current, and a darkish blue mark will appear on the paper ribbon of a length—either a dot or a dash—corresponding to the duration of the transmitted current.

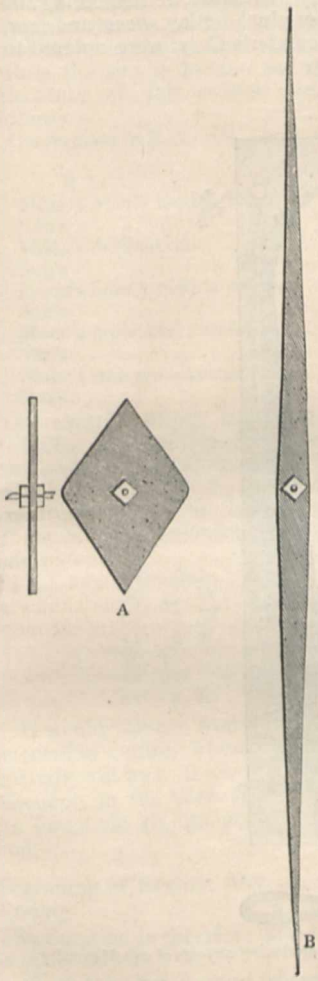

FIG. 31.—Holmes' diamond needle arrangement (A), dispensing with the astatic needle combination (B) and reducing the resistance of the coils.

William Sykes Ward's patent, by which signals were indicated by the deflection of electro-dynamic coils over the poles of fixed permanent magnets, already noticed (Fig. 18), followed in 1847. This patent became, in common with most others, the property of the Electric Telegraph Company by purchase.

Holmes's new form of coil and needle, introduced in 1848, dispensed with the inertia of the long five-inch astatic needle combination and great coil resistances of the existing double needle system, and combined a greatly increased speed of transmission with a reduced battery power, both results of vital importance. This modification of the astatic needle combination is shown at Fig. 31, drawn to actual size, as compared with the five-inch needle.

The next patent brought under notice, that of Mr. W. T. Henley, led to the first serious opposition against the monopoly of the Electric Telegraph Company. In 1848 William Thomas Henley and George Foster brought out their improvements in electric telegraphs : this patent gave rise to the formation and establishment of a formidable rival in public favour to the Electric Telegraph Company, viz., the English and Irish Magnetic Telegraph Company. The improvements under this patent consisted in acting on a magnet, to the axis of which is attached an index or pointer by a single electro or other magnet, having each of its extremities converted or resolved into two or more poles. Fig. 32 shows the magnetic needle suspended between the poles of an electro-magnet, *a*, each pole being fitted with a piece of iron, of a segmental form, developing two similar poles. This magnetic needle is deflected in one direction for any length of time required by an induced magneto-current, it being brought back to its normal position by the reversed inductive current. The necessary magneto-currents to actuate the needle are produced from a magneto-electric arrangement consisting of two coils, A, A (on an armature), which are mounted on an axis, H, between the poles, M, M, of a permanent-magnet, and free to move in front of those poles upon depression of the handle, G, in such a manner that one pole of the magnet is not released from its opposition to the armature until the other just touches it, by which means currents of equal power and in opposite directions are produced. This arrangement of parts is shown in Fig. 33. These several representative improvements, selected out of the vast numbers that crowd the field up to 1848, will be sufficient for the purpose of tracing the Progress of the Telegraph.

Such were some of the instruments already invented when electrical communication was inaugurated in this country by the Electric Telegraph Company.

Proceeding down the *cul de sac* known as Founders Court, Lothbury, a stone façade, with the words "Central Telegraph Station" sculptured in bold letters, and massive oak doors, arrested the attention of the visitor. On entering, a noble and lofty hall with an enriched glass roof presented itself to view, with two long counters, one on either side, for the receipt and payment of messages. Behind these counters glass screens were placed with the

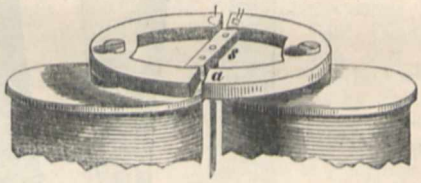

FIG. 32.—Henley and Foster's Magneto-Telegraph, 1848. Indicator movement.

names of the several stations open for messages painted in black letters upon them, the instrument rooms being behind the screens upon either side.

The west side of the hall was devoted to correspondence with the northern and western districts, and the east side with the eastern and southern districts. Additional instrument rooms were provided on the first and second floors at the sides of the hall ; and at the time of the opening of the station to the public, the Company had access to about sixty towns, with an extent of single wire along the railways of some 2,500 miles, and had a telegraph staff of fifty-seven hands appointed to the Metropolitan Station. The battery rooms, testing boxes, earth connections, and the tubes for bringing the wires into the building were situated in the basement underneath the great hall. The various wires were brought along the streets in pipes beneath the pavement. Twenty-seven came from the North Western Railway, nine from the South Western, nine from the South Eastern, nine from the Eastern Counties, nine from the branch office, 345, Strand, including those from Windsor, nine from the Admiralty, which with nine spare wires completed the circuit arrangements of the Company at the time that the telegraph was thrown open to the public. Many of the railway companies continued to reserve the use of their telegraphic lines to themselves ; the Telegraph Company from the central station had therefore no power to forward public messages over such districts.

It is natural to suppose that great excitement and anxiety existed amongst the directors with reference to the opening of the building to the public for the receipt and transmission of messages. The disturbed state of

London at that time, arising from the Chartist demonstration and supposed possible attempt upon the Bank of England, by no means allayed the disquietude of the directors ; as it was, most of the electrical staff had been sworn special constables, and truncheon in hand had assisted in guarding the principal buildings in the vicinity of the Bank of England and Royal Exchange. What if on the opening day a mob should rush in intent upon destroying the new-fangled invention ! Such occurrences had been witnessed before. Had not Arkwright with his stocking loom, and Jacquard, incurred the fury of the ignorant artisans ? Might not the rush of relatives and friends, merchants and bankers, all anxious to supersede the delays of post by the lightning speed of this new invention laid at their feet for the first time, prove so inconvenient to the clerks that all business would be interrupted, and the accuracy of the payments for messages and correctness of the transmissions be jeopardised ? Besides, another evil rumour had gone abroad : light sovereigns and indifferent gold were in free circulation. Amongst all these troubles it is not to be wondered at, that as the eventful day drew near every precaution was taken to meet the assumed exigency of the occasion ; sovereign scales were ordered, one for each counter already described. How could a clerk leave his place of trust to weigh a suspicious-looking piece of gold in scales situated on the opposite side of the great hall ? The uniform shilling rate to all places from the metropolis did not at that time exist. Messages to Liverpool and Manchester were 8*s.* 6*d.* under twenty words, to Edinburgh 13*s.*, and to Glasgow 14*s.* ; charges at that time considered very moderate, remembering the costly staff of clerks, the original outlay, wear and tear, &c. The great doors in Founder's Court were ordered to

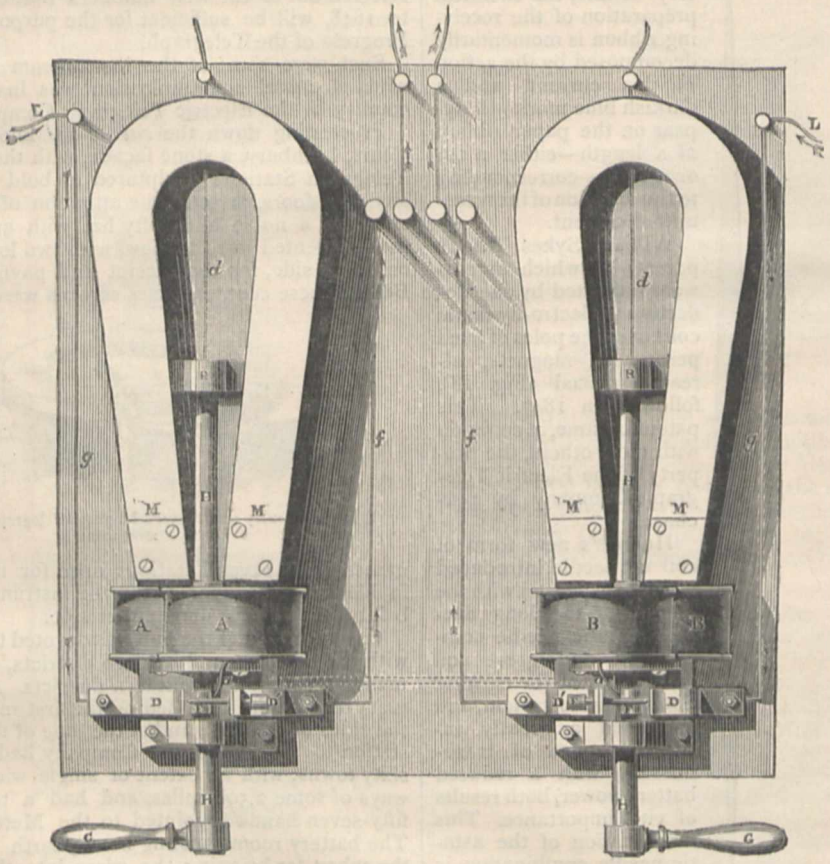

FIG. 33.—Henley and Foster's Magneto-Electric Telegraph, 1848. Plan of the magneto-coil arrangement for producing currents of equal intensity in opposite directions

be kept fast bolted, and two port-holes cut some six inches square in the solid oak panels fitted with little screens opening inwards ; so that whatever the crush in Founders Court, messages and money could be received inside through them and change given ; in fact, the Central Telegraph Station was converted more or less into a fort prepared to stand a siege. The opening day came—scales on counter, change in tills, receiving and cashing clerks at their posts, every instrument and circuit along the respective railway lines proved for accuracy by the sending and receipt of test signals, staff at instruments, doors bolted. Nine o'clock strikes, port-holes opened, and, after the manner of the stage manager behind the curtain who surveys the patronage bestowed upon the boxes, stalls, and dress circle from his mysterious peephole, so did the expectant staff view the state of Founders Court through their port-holes. Not a person disfigured the symmetry of the lines of the flag pavement, save the Bank of England porter, performing his prescribed beat against the Bank wall. The sun marked midday,—afternoon, —evening,—and one paid message alone was transmitted to a station situated somewhere upon the Norwich circuit. Empty tills, idle clerks, disappointed directors. Such was the story of the opening day of the Electric Telegraph Company's Central Office. No one believed in it ; it was regarded more in the light of a clever toy than a practical invention to be trusted or relied upon. This want of patronage from the public damped the ardour of some of the directors. The late Mr. Sampson Ricardo, walking into the central station the next morning, gave vent to his disappointment by declaiming on the extravagant expenditure of capital in two pairs of sovereign scales, demanding that one pair should be immediately returned to the scale-maker who had supplied the luxury.

After the vast expenditure of capital in the purchase of the Cooke and Wheatstone patents, erection of lines over the kingdom, station inauguration, and the incorporation of the Company by special Act of Parliament, naturally the promoters of the Electric Telegraph Company endeavoured to create a monopoly in the transmission of messages for the public.

(*To be continued.*)

OUR ASTRONOMICAL COLUMN

THE TOTAL SOLAR ECLIPSE OF 1886, AUG. 29.—This eclipse will be a remarkable one, on account of the length of duration of totality, which will not fall far short of that of the eclipse of 1868, Aug. 18, though it unfortunately happens that its track is mainly over the Atlantic Ocean, and there will be no land station for physical observations while the sun is hidden for the longest interval. The elements of the eclipse are, very approximately, as follows :—

Conjunction in R.A. 1886, Aug. 29, at 0h. 57m. 37·7s. G.M.T.

	°	′	″	
R.A.	157	50	51·9	
Moon's hourly motion in R.A.		37	4·8	
Sun's ,, ,, ...		2	16·7	
Moon's declination	9	10	38·4	N.
Sun's ,, ...	9	17	23·9	N.
Moon's hourly motion in Decl.		10	45·1	S.
Sun's ,, ,, ...		0	53·4	S.
Moon's horizontal parallax		61	20·5	
Sun's ,, ...			8·8	
Moon's true semidiameter		16	42·9	
Sun's ,, ...		15	51·1	

The central eclipse begins Aug. 28, at 23h. 12m. 32s. G.M.T., in longitude 79° 33′ W., and latitude 9° 51′ N., and ends Aug. 29 at 2h. 36m. 28s. in longitude 47° 19′ E., and latitude 21° 57′ S., and the sun is on the meridian centrally eclipsed in longitude 14° 13′ W., and latitude 2° 58′ N. The following are also points upon the central line :—

Longitude.	Latitude.
66° 47′ W	11° 36′ N
61 1 W	12 6 N
11 9 E	11 5 S
20 10	14 52
21 39	15 25
25 5 E	16 36 S

It would appear from this track that the only easily accessible station where the sun will be at a sufficient altitude will be at the southern extremity of the Island of Grenada, in the West Indies; for which point, assuming its longitude 4h. 6m. 20s. W. and latitude 11° 59′ N., we find—

	H.	M.	S.	
Beginning of totality, Aug. 28, at	19	10	7	Local
Ending ,, ,,	19	13	22	mean times.

The duration is therefore 3m. 15s., and the sun's altitude is about 20°.

If we take for a point where the sun will be near the meridian, longitude 0h. 50m. 52s. W. and latitude 2° 8′ N., we have—

	H.	M.	S.	
Beginning of totality, Aug. 29, at	0	8	48	Local
Ending ,, ,,	0	15	14	mean times.

The duration of total eclipse, which is here nearly at its maximum, is therefore 6m. 26s., and the sun at the time is only 7° from the zenith.

From this point the length of totality diminishes, until, during the passage of central eclipse over Southern Africa from near St. Philip de Benguela to the Mozambique, it is comparatively short. It will be seen that the central line runs considerably to the north of the islands of Ascension and St. Helena.

The middle of general eclipse occurs at 0h. 54m. 30s. G.M.T.; the sidereal time at Greenwich mean noon is 10h. 30m. 27s·8, and the equation of time 0m. 46s. subtractive from mean time, figures which may facilitate a further examination of the phenomenon.

THE SUN'S PARALLAX.—Prof. Galle, Director of the Observatory at Breslau, in a letter to M. Leverrier, gives the definitive result of his discussion of observations of the minor planet Flora (Hind, 1847, Oct. 18) in the autumn of 1873, at observatories in both hemispheres, with the view to a determination of the solar parallax. The receipt of particulars concerning some doubtful observations at Melbourne and other stations had enabled him to apply some small corrections, by which, however, the value of the sun's parallax published in No. 2,033 of the *Astronomische Nachrichten* is but very slightly changed. Prof. Galle now finds from eighty-one corresponding observations between the two hemispheres, forty-one stars of comparison to the north of the planet and forty to the south, that "the definitive result for the solar parallax should be fixed at $\pi = 8''{\cdot}873$, with a very small uncertainty in the hundredths of the second." He adds, that of ninety-six corresponding observations in all, he had excluded fifteen on account of some discordances arising from imperfections in the southern instruments, but even if these fifteen observations were included, the value is only changed to $8''{\cdot}878$. Prof. Galle is engaged in the composition of a memoir giving full details of his investigation. He remarks upon the close agreement of his result with that obtained by the numerous and very exact measures of the velocity of light, by M. Cornu, at the Observatory of Paris, with the theoretical determination of M. Leverrier from the perturbations of the planet Mars, and with M. Puiseux's first result from observations of the transit of Venus at Pekin and St. Paul Island. He directs attention to the circumstance, that another favourable opportunity of applying the method which has furnished a value for the sun's parallax by observations of Flora in the northern and southern hemisphere, so nearly in agreement with values deduced in other ways, will be afforded about the opposition of Eurydice (Peters, 1862, Sept. 22), which occurs on the 20th of September next, when the planet will be a bright ninth magnitude. It will be in perihelion early in the previous month, and at its nearest approach to the earth on Sept. 13, will be distant less than 0·878 of the earth's mean distance from the sun. Prof. Galle hopes to secure on this occasion the co-operation of the astronomers who have taken part in the observations of Flora.

THE MINOR PLANETS.—On comparing elements of this group as known to the present time, it appears that *Flora* has the shortest period of revolution, 1193 days, and of those which have been satisfactorily calculated, *Sylvia* has the longest, 2374 days, the corresponding mean distances, expressed in parts of the earth's mean distance from the sun, being 2·201 and 3·482. The nearest approach to the sun is made by *Phocea*, 1·787, while *Freia* recedes furthest from him, the aphelion distance being 4·002. We may add to these the following values near the extremes of distance :—

	Distance in Perihelion.		Distance in Aphelion.
Melpomene	1·796	Sylvia	3·757
Clio	1·805	Cybele	3·803
Victoria	1·823	Pales	3·810
Iris and Ariadne ...	1·835	Euphrosyne	3·849
Eurydice	1·854	Hermione	3·882
Flora	1·856		
Polyhymnia	1·890		
Virginia	1·899		

Polyhymnia has the greatest excentricity, 0·33998, and *Lomia* the least, 0·02176; *Pallas* the greatest inclination, 34° 42′, and *Massalia* the least, 0° 41′. It will be seen that the difference of distance from the sun between Phocea in perihelion and Freia in aphelion is 2·215, corresponding to about 204,000,000 miles.

M. Leverrier's *Bulletin International* of June 5 con-

tains a telegraphic intimation from the Smithsonian Institution of the discovery of a new minor planet by Prof. Peters in R.A. 17h. 21m., and N.P.D. 113° 21′. It is as bright as stars of the eleventh magnitude, and is No. 144 of this group of planets.

[Since the above was in type we receive notice of the discovery of No. 145, by Prof. Peters, in R.A. 17h 14m, N.P.D. 113°·8′, apparently on June 4. Motion towards S. : twelfth magnitude.]

LECTURES AT THE ZOOLOGICAL GARDENS *

VI.—*Mr. Flower on Elephants.*

WITH the exception of the domesticated species few mammals are so well known to everyone as the Elephant, few are more interesting from their sagacity and usefulness to mankind, and few are so wholly separated and isolated from all other forms which now exist. Formerly the Elephants were grouped with the Rhinoceroses or with the Pigs, but a better knowledge of their structure has shown that they form an entirely distinct order, to which the name *Proboscidea* has been given, on account of the trunk, or proboscis, which is one of their most striking features. Two well-marked species of Elephant exist, the Indian (*Elephas indicus*) and the African (*E. africanus*).

The former is found in a wild state throughout the forest-lands of the greater part of India, Ceylon, Burmah, Siam, Cochin-China, the Malay Peninsula, and Sumatra, except where it has been driven back by the advance of civilisation ; whether it is indigenous to any of the other islands of the Eastern Archipelago is doubtful. The Elephant of Sumatra and Ceylon has been separated by Schlegel as a distinct species, *E. sumatranus*, but Dr. Falconer and others have shown that their differences, though appreciable, do not amount to specific characters. The Indian Elephant has been domesticated from the earliest ages—in India before historic times, and also by the ancient Persians. It has been used in war, in carriage, and in state pageants, and is still much employed in road-making and bridge-building, where its strength, its sagacity, and its adroitness in piling logs, lifting weights, and similar operations, render its services invaluable.

The second species inhabits Africa, south of the Sahara, from the Indian Ocean to the Atlantic, and formerly extended its range to the Cape of Good Hope. In ancient times it was domesticated by the Carthaginians, and was the species generally imported by the Romans, but no succeeding African race has had the sagacity to make use of it. It is killed in vast numbers for the sake of its ivory, of which an enormous quantity is annually brought to Europe ; and in so wasteful a fashion is this slaughter carried on, that the species will probably soon be exterminated. Although so well known to the ancients, it is only quite recently that live African elephants have been brought to Europe in modern times. There was one in Antwerp in 1863, and two years later a pair were obtained by the Zoological Society, which are still alive and well, the male having attained a height of ten feet. Since this, numbers of these animals have been imported down the Nile from the Soudan, and they are now common in menageries.

In size there is not much difference between the two species, and the maximum height would appear to be about eleven feet ; an Indian elephant shot by Sir Victor Brooke reached that stature, which was not exceeded by the tallest of eleven hundred individuals measured by Dr. Falconer. In external appearance the two species are easily distinguishable. The African elephant has a lighter and more shapely head, a less protuberant forehead, and a larger eye, but its most striking peculiarity is the enormous size of its ears. It also stands proportionately higher on its legs, and has a more arched back. The number of nails is different, being four on the fore feet and three on the hind, whereas in the Indian species these feet have four and five nails respectively. Sportsmen say that the height of an elephant always equals double the circumference of the foot, and this is confirmed by the individuals now in the Gardens ; in the male the proportion is absolutely correct, and in the female it is within three inches. The mental characters of the Indian and African elephants are different, the latter being bolder, quicker, and more obstinate.

In considering the general structure of the Elephants, the first peculiarity to be noticed is the trunk, which is really an enormous prolongation of the nose and upper lip. It is almost entirely composed of a complex mass of muscles which give it its great power and flexibility, and it is amply supplied with nerves. The great massiveness of the head is not owing to the size of the brain, but to huge air-cells in the body of the bones, which are an extraordinary development of the frontal sinuses. This expansion is necessary to afford room for the attachment of the great muscles which wield the head and proboscis.

The teeth of the Elephant are very peculiar. The tusks, which answer to the middle incisors of man, sometimes reach a weight of 150 lbs., or even, it is said, of 200 lbs. each. They have no enamel, being entirely composed of *ivory*—a peculiarly fine, tough, and elastic dentine—and are persistent in growth throughout life. Thus, if bullets happen to lodge in the pulp-cavity they are carried down by the growth into the tusk itself, in which they are sometimes found embedded. The molars are six in number in each side of each jaw, and are composed of alternated transverse plates of enamel, dentine, and cement. Owing to the different hardness of these materials they wear unequally, and produce cross ridges on the surface of the tooth, which form it into an admirable grindstone for crushing the food. The molars are not deciduous, but move forward in a curious way ; only one (or at most a part of two) is in use at once, and each as it is worn away is pushed forwards by its successor, which eventually takes its place. The six teeth last out the life of the animal, which is said to extend to a hundred years or more. In the Asiatic species the plates of the molars are much finer and more regularly parallel than in the African elephant, in which they are fewer in number and have somewhat of a lozenge shape.

It was formerly a widespread delusion that the Elephant had no joints, and even now many people believe that their joints move in the contrary way from those of other quadrupeds. The explanation of this lies in the fact that the elbow and knee of an elephant are much nearer the ground than those of a horse or a cow, and are thus confused by a casual observer with the so-called "knee" (the true wrist) and "hock" (the true ankle) of the latter animals.

Although the Elephants are now so isolated among animals, it was not always so. They have many fossil relatives whose range once extended all over Europe (including Britain), Asia, North America, and part of South America. Of these the most generally known is the Mammoth, of which specimens have been so wonderfully preserved in the Siberian ice, and which was closely allied to the living Asiatic species. Going further back we have the Mastodon, in which the grinding teeth were much less differentiated and more like those of other animals. Beyond this it is difficult to trace their relationships. Possibly they may have been through the Dinotherium, or through some of the wonderful creatures whose remains have recently been discovered in the Eocene formations of America. But it is clear that in the Elephants we have the last remaining representatives of a mighty and once numerous race which have played their part in nature and disappeared, and it is only too probable that the survivors also are doomed to speedy extinction.

* Continued from p. 93.

SCIENCE IN GERMANY

(*From a German Correspondent.*)

IT is not only due to the quantitative increase of scientific work, but also to the exigencies of the division of labour, that the German serials dedicated to zoological and anatomical research have been augmented by two new ones this year.

The *Morphologisches Jahrbuch*, edited by Carl Gegenbaur, Professor at Heidelberg, unites anatomy and the history of the development of animals in their mutual and intimate relation as animal morphology. It has for its first object the recognition of the intimate relations amongst different degrees of animal organisation, and further, to consider the anatomy of man as illustrated by the knowledge of the construction of lower organisms. This programme evidently excludes all descriptions and one-sided observations which cannot be used for the above purpose. The first number contains papers on the extreme ends of the animal world, viz., Man and Infusoria, and thus illustrates the end in view most perfectly. The *Jahrbuch* will be supplemented annually by a yearly report of the progress of the anatomy of Vertebrata. This serial appears quarterly in numbers of from 6 to 10 sheets of text, with plates, at the price of from 6 to 9 marks.

Zeitschrift für Anatomie und Entwickelungsgeschichte ("Journal of Anatomy and History of Development"), edited by W. His and W. Braune, Professors of Anatomy at the University of Leipzig. The principal object of this new serial is to be the knowledge of the human body; but papers will also be received which touch upon this theme from a somewhat more distant point of view. At the same time attention will also be turned to the practical side of this subject as well as the theoretical, and materials will be offered to the medical man which will be of immediate use to him in his sphere of action. The double number published of this serial shows that its programme has very wide limits and will eventually be of interest to the zoologist and anatomist, as well as to the practical physician. A number of this serial will be published every two months, containing about five sheets of text and five plates, at the price of from 6 to 8 marks.

NOTES

THE Local Secretaries of the Bristol Meeting of the British Association are doing all in their power to make it in every way a success, and to secure the comfort and enjoyment of those members who may attend; and we think we may promise all who do a pleasant time of it. Although the railway companies have obdurately refused to grant any special concessions to those who will attend the Bristol Meeting, we have reason to believe that the usual complaints as to hotel charges will not have to be made; all the principal hotels have given assurance that their tariffs will not be raised, except in the case of beds, the charge for which, quite naturally, will be slightly increased. There are many places of scientific as well as general interest in and around Bristol; and the Bristol Museum, one of the best provincial collections in the kingdom, will be temporarily enlarged for the occasion. Excursions to various places will be arranged, and the Mayor and inhabitants of Bath have signified their wish to receive a visit from the Association. At the *soirée* on August 26 the Bristol Microscopical Society, assisted by the Naturalists' Society and the Bath Microscopical Society, has undertaken to give a systematic microscopic demonstration of the natural history of the neighbourhood; a novel feature will be the number of living objects which will be exhibited. At the second *soirée*, Aug. 31, a number of objects of great scientific interest will be exhibited. A special Guide Book is being compiled, and a very useful map of the country for many miles round Bristol has been prepared.

THE section of the Eclipse Expedition which went to Camorta returned last week. No detailed news has been received from the Siam party.

AT its last private sitting, the Paris Academy of Sciences was apprised by its Administrative Commission that the expense for the several Transit of Venus expeditions had exceeded by 80,000 francs the sum granted by the Government. A supplementary credit will be asked for from the Versailles Assembly; and M. Leverrier proposed to offer to the Government the instruments used by the several expeditions, which now belong to the Academy. These 6-inch and 8-inch refractors are large enough to be utilised in the establishment of local observatories in several provincial towns of France and Algiers. The motion was unanimously accepted on condition that the said instruments should be lent to the Academy for the Transit expeditions of 1882.

THE number of Prof. Huxley's students in Edinburgh University now amounts to upwards of 350.

THE gentlemen whose names we mentioned in a previous number (vol. xi. p. 497), were, at the annual election meeting of the Royal Society last Thursday, elected Fellows.

THE Norwegian Government has granted a credit of 4,000*l.* for an expedition to be sent out next yearunder the scientific direction of Dr. Mohn, for the exploration of the sea between Iceland, the Faroe Islands, Spitzbergen, and Jan Mayen. The commander of this expedition will be Capt. Carr Wile, of the Royal Norwegian Navy, who is now in England gathering information as to the work done by the *Challenger*.

WE take the following from the *Academy*:—Under the title of the Belgian Society of Dredging and Marine Exploration, a society has been formed for the systematic exploration of the North Sea. The annual subscription is to be 15 francs. The materials as collected are to be submitted to various scientific men who have made the different departments their special study, and are afterwards to go to form a central collection accessible to all the members. Duplicate specimens not required for this purpose are to be sold each year at one of the meetings of the Society. The circular which has been issued suggests that, by means of such a society, Belgium may be able to contribute its share to the advancement of that branch of science for which so much has been done by our own countrymen. We need not say that we wish it every success.

WE are glad to learn that Capt. Hoffmeyer, director of the Royal Danish Meteorological Institute at Copenhagen, intends to continue the publication of his daily Synoptic Meteorological Charts for the third quarter, June to August 1874. The charts are constructed from every available source for the region embraced, viz., from about lat. 30° to 70° N., and from long. 40° W. to 40° E. of Paris. The cost of subscription in this country is 12*s.* 6*d.* for the three months, but as only a limited number is printed, application should be made at once to Mr. R. H. Scott, director of the Meteorological Office, 116, Victoria Street, London, S.W.

WE understand that Prof. Boyd Dawkins, of Owens College, leaves this week for Sydney, *viâ* the Suez Canal. After conducting a geological exploration in Australia, he intends returning by San Francisco, reaching England in October, thus making the circuit of the world in about 120 days.

AT its last sitting the Council of the Paris Observatory passed resolutions relating to the observation of intra-Mercurial planets and the determination of the velocity of light by the satellites

of Jupiter and by aberration. These last researches are intended for the verification of the numbers obtained by the parallax of the sun and by Cornu's direct experiments. A beginning will be made as soon as the necessary funds have been granted by the Ministry. The intra-Mercurial planets are to be observed photographically when crossing the disc of the sun. These researches will be commenced as soon as the fitting up for photographic purposes of the great Arago refracting telescope is finished.

IT is expected that the French Academy of Sciences will hold its annual meeting for distribution of prizes on the 21st inst.

M. LABOULAYE, a Professor in the College of France and an influential member of the French Assembly, read, at the sitting of the latter on June 5, a report, drawn up by him in the name of a special commission, asking the establishment in France of Free Universities. M. Wallon, the French Minister of Public Instruction, is said to be greatly in favour of the scheme.

A STRANGE case of poisoning is reported from Stettin. A gentleman had bought a hat in a shop there, and, after having worn it for one or two days, was troubled with unbearable headache; at the same time little ulcers formed upon his forehead, his eyes were inflamed, and the whole of the upper part of his head was much swollen. It was evident that these symptoms were caused by the hat, and upon examination by a chemist it was found that the brown leather in the inside of the hat was coloured with a poisonous aniline dye. It appears that inflammation is unavoidable when this dye is in contact with any part of the skin.

DR. OSCAR FRAAS, director of the Natural History Museum and Professor of Geology at Stuttgart, has arrived at Beyrût, invited by Rustem Pasha; he intends to study the Lebanon geologically and mineralogically, and to work out a geological map of that range of mountains.

THE great meeting of German ornithologists took place at Brunswick on May 20–23. Brehm, Cabanis, Homeyer, Blasius, Reichenow, Pralle, and many other members of the two ornithological societies, were present. The first meeting led to the union of the two societies. It was resolved to request all the members to report to a Committee from time to time all observations of interest to science, agriculture, or the economy of forests, that they may make, on the life, manners, use, &c., of German birds. The Committee is to publish the materials thus obtained, after due consideration and sifting.

IN a letter dated Constantinople, May 20, the *Kölnische Zeitung* gives some details on the earthquake which took place on the west coast of Asia Minor. On the 11th of May, at 5 A.M., a severe shock was felt at Smyrna which lasted several seconds. Two other shocks followed the same morning, and although many houses were shaken, yet none fell. It is thought that the centre of the earthquake was in the Sporades Islands. According to other reports on the dreadful earthquake of the 3rd–5th of May in the interior, the sources of the Mæander river were indicated as the centre of the volcanic action. This point is situated in the canton of Ishikli, to the south of Ushak and Afium Karahissar. The destruction was fearful at Ishikli: about 1,000 houses were completely destroyed and several thousand people killed; only about twenty dwelling-houses and two mosques are now standing. In the village of Yivril not one of 300 houses is left, and about 450 dead have been extricated from the ruins. Not far from there an immense chasm has formed in the ground, from which is running a stream of hot water. The village of Yaka is likewise annihilated. In other villages, as Savasli, Karayapli, &c., the inhabitants escaped with a violent shock.

A REUTER'S telegram, dated New York, June 7, states that an earthquake has occurred at the Loyalty Islands, a tidal wave at the same time sweeping over three villages.

AT a meeting of the Upper-Rhenish Geological Society, which took place at Donaueschingen on May 23, Dr. Knop, of the Polytechnic Institution of Karlsruhe, read an interesting paper on the phenomenon of disappearance of the waters of the Danube, in some rugged piece of ground over which the river flows near Immendingen. Dr. Knop has been ordered by the Baden Government to investigate the matter scientifically. It is supposed that the little river Aach, which flows into the Lake of Constance, and thus into the Rhine, is the result of this phenomenon, as there can be no doubt that the volume of the Danube is considerably diminished after having passed over the spot in question. The present, *i.e.* the visible source of the Aach, is near the village of the same name, and the river flows from a cavern of several hundred feet in circumference, from underneath overhanging rocks, with great velocity and force; it turns several waterwheels close to its source. A chemical analysis of its water is now being made, with a view of ascertaining whether the water is of the same composition, *i.e.* contains the same impurities as that of the Danube.

SEVERAL writers in the *Belgique Horticole* have given the results of their experience in managing marine aquariums. A certain Mr. Bauwens says that he has possessed a marine aquarium now nearly ten years, *and the sea-water has never been renewed.* All that he does is to add fresh water as the salt water evaporates, the same degree of saltness being invariably maintained. Various species of small seaweeds and several molluscs thrive without further care, but some species of Actinia raised in the same medium were starved to death when the owner was absent from home for a considerable time. He made it a practice to feed them with a little mould, worms, or even raw meat.

THE quality of water in relation to its fauna and flora has been the subject of investigation by some of the French Academicians. In substance the results seem to prove that water in which animals and plants of higher organisation will thrive is fit to drink; and, on the other hand, water in which only the infusoria and lower cryptogams will grow is unhealthy. If the water become stagnant and impure, aquatic plants of the higher order will languish and disappear, and the half-suffocated fish will rise near the surface and crowd together in parts where there may still be a little of the purer element trickling in, and if driven from these places they soon die. *Physa fontinalis* will only live in very pure water; *Valvata piscinalis* in clear water; *Limnæa ovata* and *stagnalis* and *Planorbis marginatus* in ordinary water; and, finally, *Cyclas cornea* and *Bithynia impura* in water of middling quality—but no mollusc will live in corrupt water. Plants also exercise a reactive influence on the quality of water. The most delicate appears to be the common watercress, the presence of which indicates excellent quality. Veronicas and the floating water-weeds flourish only in water of good quality. The water-plantain, mints, loosestrife, sedges, rushes, water-lilies, and many others, grow perfectly well in water of moderately good quality. Some of the sedges and the arrow-heads will thrive in water of very poor quality. The most hardy or least exacting in this respect is the common reed, or *Phragmites communis.*

AMONGST the recent additions to the Southport Aquarium are a Sturgeon, seven-and-a-half feet in length, captured at low tide in the estuary of the Ribble, and a large specimen of the Wolf Fish (*Anarrhichas lupus*), from Norway.

THE foundation-stone of an aquarium was laid at Rothesay, in the Island of Bute, on Saturday.

TO-DAY, at the Mansion House, a public meeting will be held in connection with the Cambridge University Extension Scheme; the Lord Mayor will preside.

In last week's *Journal* of the Society of Arts will be found a very interesting paper by Mr. P. F. Nursey, C.E., on Toughened Glass.

The Conversazione of the Society of Arts will be held on the 25th inst. at South Kensington Museum.

Mr. Watts, who visited Iceland last year, and ascended the Vatna Jökel to a higher point than had previously been reached by any traveller, sailed from Granton last week for Reykjavik. He is to resume his travels in the interior of Iceland during the present summer. There is still a large portion of the island unexplored, and, as it is very mountainous and covered in some places with perpetual snow, the work of exploration is attended with great danger and difficulty. With the assistance of some of the Icelanders, however, it is hoped that this inhospitable region may be crossed over and examined, so that its topographical and mineralogical character may be determined more exactly than has yet been done.

A letter from the Secretary of the Italian Society of Sciences to the Paris Academy, states that the Italian *savants* have agreed to support a proposition issued by the Royal Society of Edinburgh, that the large tables of logarithms calculated by M. Prouy should be published at the common expense of all nations wishing to contribute to an enterprise of common interest for mankind. These tables were calculated as far back as the beginning of the present century, at the expense of the French Government. The manuscript, which escaped the vandalism of the Communists, is safe in the Archives of the Academy, and cannot be published solely for want of funds.

Dr. Nachtigall, the African explorer, has received the commands of the German Emperor to wait upon his Majesty at Ems. The Berlin Geographical Society gave Dr. Nachtigall an enthusiastic reception on the 2nd inst., at which the eminent traveller briefly sketched his six years' work in North Africa. The reception was followed by a banquet in the Zoological Gardens, at which Dr. Nachtigall received an autograph letter from the Emperor conferring upon him the Order of the Royal Crown. On Tuesday last the traveller was received in audience by the Imperial Crown Prince at the new Palace at Potsdam.

Preparations are being made for the erection of a handsome new museum in Dunedin, New Zealand.

The boys and girls who assembled in the theatre of London University on Monday for the distribution of prizes and certificates gained in the Cambridge University local examinations were particularly fortunate in having as chairman Sir W. V. Harcourt. The address he gave was unusually pointed and impressive; the criticism he made on the results of these examinations, and the wholesome truths he uttered on what education really means, must have had an excellent effect on many of those who heard them, both old and young. "The object of education," the chairman reminded his hearers, "was not the immediate knowledge which it gave them, but it was the instrument by which they might learn hereafter." When parents and teachers are universally impressed with this great truth, we may expect to see something like a revolution take place in our educational systems. These local examinations have one excellent result in bringing out the directions in which particular classes of pupils are apt to fail, and ought to be of great service to teachers who aim at making a science of their profession.

Owens College, Manchester, has received the first instalment, 57,000 dols., of a legacy left to it by Mr. Charles Clifton, an American engineer, a native of Yorkshire. A considerable additional balance is expected to be handed over presently.

The *Pandora*, three-masted schooner, originally a despatch vessel belonging to the Government, and which was purchased a few months ago from the Admiralty for private Arctic exploration, is now lying in the inner dock at Southampton, after having undergone a thorough overhaul and refit. The *Pandora* has been specially adapted for an Arctic cruise. She will leave England about the 18th inst., and, as Lady Franklin is understood to be largely interested in her equipment, the *Pandora* will probably follow in the footsteps of M'Clintock in search of further remains of Sir John Franklin. The vessel is propelled by a feathering screw, is of 439 tons burden, and a quick sailer. The *Pandora* will be commanded by Mr. Allen Young, who has already seen much Arctic service, and Lieut. Lillingston, R.N.

Just before the leaving of the Arctic Expedition a deputation from the Bremen North Pole Society visited Portsmouth with a view to consulting Capt. Nares regarding co-operation between the English Expedition and a German Expedition which may possibly be sent out next year.

The first Annual Report of the Yorkshire College of Science at Leeds is as satisfactory as could be expected. The College was opened in the end of last October with three professors—A. W. Rücker, Mathematics and Physics; Dr. T. E. Thorpe, Chemistry; and A. H. Green, Geology and Mining. Though the number of day-students has been small, the professors report in satisfactory terms of the progress that has been made. In addition to the day lectures, short courses of evening lectures have been given, which have been most successful. At the request of the Wakefield branch of the Ladies' Council of the Yorkshire Board of Education, arrangements were made for the delivery at Wakefield of a course of lectures, by Prof. Green, on the Geology of the West Riding; the lectures were in every way a success, and this field of operations is likely to be developed. The Clothworkers' Company had endowed a Chair of Textile Industries; the professor, Mr. W. Walker, commenced his lectures to a good class, but for some reason resigned his chair in January. On the whole, this Report is an encouraging one, and if the friends of the scheme only persevere and see that the College is founded on a sufficiently broad basis, we have no doubt of its ultimate complete success.

The following statistics have been published by the French Minister for Public Instruction:—Thirty per cent. of the population cannot read or write, but the proportion is smaller amongst the males, as the conscription lists give only nineteen per cent. at nineteen years of age. There are thirteen scholars for every 100 inhabitants, and one school for every 500, or 70,000 schools for the whole of France. The expenses of primary education are 70,000,000 fr.—about 40*l.* per school, or about 1*s.* 8*d.* per head of inhabitants, or 12*s.* per pupil.

We regret to learn from the *Geographical Magazine* that through the omission of the French Commissioners to ask the German Government to appoint a Commissioner to the forthcoming Geographical Exhibition at Paris, it is not likely to be very complete so far as maps are concerned. The absence of the great German map-publishing firms would be matter for regret.

The additions to the Zoological Society's Gardens during the past week include a Brown Capuchin (*Cebus fatuellus*) from Guiana, presented by Mr. Charles Wilson; a Kuhl's Deer (*Cervus Kuhlii*) from the Bavian Islands, two Victoria Crowned Pigeons (*Goura Victoriæ*) from the Island of Jobie, two Bornean Fireback Pheasants (*Euplocamus nobilis*) from Borneo, two Great Black Cockatoos (*Microglossa aterrima*) from New Guinea, a Derbian Screamer (*Chauna derbiana*) from S. America, purchased; a Chimpanzee (*Troglodytes niger*) from W. Africa, six Argus Pheasants (*Argus giganteus*) from Malacca, deposited; four Peacock Pheasants (*Polyplectron chinquis*), an Eland (*Oreas canna*), and a Virginian Deer (*Cervus virginianus*) born in the Gardens.

SCIENTIFIC SERIALS

Poggendorff's Annalen der Physik und Chemie, Nos. 3 and 4, 1875.—These parts contain the following papers:—Remarks on electro-dynamics, by F. Zoellner. These refer to Ampère's law and Helmholtz's potential law.—On the proportion of temporary magnetism to the magnetising force and its relation to the reciprocal action of the metallic particles, by E. Boernstein.—Remarks on the paper of Dr. Streintz, on the torsion oscillations of wires, by O. E. Meyer.—On the conducting resistance at the points where metallic conductors touch, by F. C. G. Müller.—On the specific heats of the elements carbon, boron, and silicon, by Dr. H. F. Weber; this is the first paper on the subject, and treats on the dependence on temperature of the specific heats of the isolated elements in question.—On the path of the rays of light in a spectroscope, by Dr. J. L. Hoorweg.—On electrodes which cannot be polarised, by A. Oberbeck.—On the conduction of electricity in electrolytes, by W. Beetz.—Supplement to K. L. Bauer's paper (vol. 153, p. 572, of these *Annals*) on the apparent position of a point of light situated in a denser medium, by the author.—General theorems on the images of spheric mirrors and lenses, by the same.—On the theory of the process of assimilation in the vegetable kingdom, by E. von Benkovich.—On a simple method of finding the poles of a rod magnet, by F. C. G. Müller.—On the determination of the velocity of light and the parallax of the sun, by A. Cornu. This paper is taken from the *Comptes Rendus*.—On the unipolar conduction of electricity through layers of gases of different conducting capacity, by C. Braun.—New researches on the currents in electric machines, by F. Rosette.—Some remarks on Helmholtz's theory of vowels, by E. van Qvanten.—On the theory of anomalous dispersion, by H. Helmholtz.—On an electric fall machine, by H. Waldner.—On the experimental determination of diamagnetism by its action of induction, by A. Toepler.—On an optical method of studying the oscillation of solids, by O. N. Rood.—On a new kind of variation sounds, by V. Dvorak.—On the spectrum of the zodiacal light, by Arthur W. Wright (from the *American Journal of Science*).—Some remarks on Thomson's electrometer, by K. A. Holmgren.—Electroscopic note by the editor.

Geographical Magazine, May.—A long and interesting article on the late Admiral Sherard Osborn is the first and chief article in this number, and is followed by one on the Arctic Expedition. Other articles are on "The Salt-farms of the Loire," by Horace St. John; an interesting account of the town of Kulja, in Russian Turkestan, by A. Vámbéry; on the Khivan Mission to India in 1871, by Robert Michell; a short article on Dr. Nachtigall's travels in Africa, with a well-constructed map; besides reviews, reports of societies, &c.

Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie, April 1.—In continuation of his article in the last number, Dr. Hann proceeds to calculate from the formula (I.) the gradients of two storms, one of which was violent at Vienna on January 27, 1874, and the other a tropical hurricane which passed over the island of St. Thomas on August 21, 1871. In the first case ΔB, expressed in millimetres per 50 miles, amounts to 3·125, of which 2·7 is due to the rotation of the earth, and ·4 to centrifugal force. In the second, the earth's rotation causes a difference of 1·25, and centrifugal force of 8·87, the whole ΔB being 10·12. A difference of pressure amounting to 9·02 at a distance from the centre of 57 miles, is caused in this case by a velocity of 30 metres per second. Thus, in storms of small diameter, the effect of centrifugal force greatly exceeds, and in our cyclones falls far short of, that of the rotation of the earth. If the air streams towards or (in lofty regions) from the centre, another factor must be introduced into equation (I.) representing resistance to movement. Now, in spiral gyration, the full centrifugal force is not exerted, and we may divide the real velocity into two components, one in the direction of the tangent, and the other at right angles to it. Calling the angle between the direction of movement and the tangent i, the first component will be represented by $v \cos i$, and on this depends the centrifugal force. Finally, we have, according to Ferrel, for a spiral storm the equation—

$$\text{(II.)} \quad \Delta B = \frac{l}{287{\cdot}4} \cdot \frac{B}{T} \cdot \frac{(2n \sin \phi + u)v}{\cos i}$$

where $u = \frac{v \cos i}{r}$ where r = distance from axis of rotation.

Dr. Hann remarks that that portion of the gradient derived from $2n \sin \phi v$ is really independent of the value of i, but according to the formula it increases with the increase of i, and this must be an error. Besides, the second factor, representing centrifugal force, on analysis appears to be independent of i, and so we get too large a quantity for the gradient. With respect to the velocity of the wind, we see that the rate cannot be proportional to ΔB alone in all parts of the cyclone in the same latitude; and further, that in different latitudes the value of v for the same gradient is nearly inversely proportional to the sine of the latitude. On the subject of tornadoes, Dr. Hann says that if the earth were not rotating, the tendency of the air to restore equilibrium would prevent any greater disturbances than those which are now observed at the equator. Water before at perfect rest, when an orifice is made in the containing vessel, flows through without producing circulation, but the least original movement causes rapid rotation. In tornados the influence of the rotation of the earth is small in comparison with that of the original condition of the atmosphere. Hence the variable direction of rotation. Large cyclones are not found near the equator. Tornadoes, having no constant force acting to maintain them, must soon be spent. The direction of progression of cyclones can be explained by the inequality of centrifugal force on their north and south sides. On the north side, that part of the gradient depending on $2n \sin \phi$ is greater than on the south side; the cyclone accordingly moves in the direction of least pressure, viz., towards higher latitudes.

Der Zoologishe Garten.—In the number for March, J. von Fischer remarks on the habits in captivity of the common and Mozambique Ichneumons (*Herpestes ichneumon* and *H. ornatus*); the former is more diurnal and arborial in its manner of life, and is much more playful and tameable than the latter.—A. Petry gives an account of a viper (*Pelias berus*) which gave birth in solitary confinement to one young one, and *fifteen weeks* later to three more.—E. Buck remarks on the life of various species of *Acineta* in the aquarium, and Herr Director Rueff on the history of zoological gardens.—A curious instance of the attachment of the cuckoo (*Cuculus canorus*) to its egg is recorded on the authority of Herr Förster Amort by Victor Ritter von Tschusi-Smidhofen, and Herr von Bothmer gives an interesting account of two tame otters (*Lutra vulgaris*).

Jahrbuch der Kais-Kön. geologischen Reichs-Anstalt. No. 3, band xxiv., 1874. *Hierzu*: Dr. G. Tschermak, *Mineralogische Mittheilungen*, band iv., heft 3.—The first paper in this number of the *Jahrbuch* is one by Ludw. v. Vukotinovic, on the tertiary strata in the neighbourhood of Agram (Croatia). These are divided into two groups, the *lower*, consisting of limestone (nullipore in part), with which is associated sandstone, sometimes fine-grained, sometimes coarse, and pale grey sandy marls; the *upper* (brackish group) being composed of grey and yellowish brown sandstone, yellow or white sand, and gravel and shingle. In general, a striking resemblance can be traced between these Agram tertiary deposits and the strata of the so-called Vienna basin. This holds good with at least the Upper Tertiary or Miocene; but as regards the brackish water group, some difference obtains. But this the author believes is only what might have been expected when consideration is had to the varying local conditions under which the deposits must have been accumulated. An account of the brown coal of Croatia and Slavonia is furnished by C. M. Paul. He tells us that brown coal occurs at five different geological horizons in the Tertiary strata of those districts. According to the index, we should have a paper by Dr. O. Lenz, on the ancient glacier of the Rhine, but it does not appear in this number.—Among the *Mineralogische Mittheilungen* we note specially two papers: Petrographical observations on the west coast of Spitzbergen, by Dr. R. v. Drasche; and on some trachytes of the Tokay-Eperieser Mountains, by Dr. C. Dölter. The rocks this author describes are augite andesite (augite andesite lava), amphibole-andesite, quartziferous augite andesite, rhyolite (quartziferous sanidine trachyte), and sanidine trachyte lava; analyses of a number of these rocks are given. There is also an interesting preliminary notice of a new circular-polarising substance, by Dr. C. Hintze.

Allgemeine Schweizerische Gesellschaft für die gesammten Naturwissenschaften.—The publication of this society, vol. xxvi (1874), contains only one, but a very elaborate treatise, with two plates, on the ants of Switzerland. It gives their classification, their habits, anotomical and physiological notes regarding them, and remarks on their geographical distribution, together with many new observations regarding their mode of life, &c. The author is Dr. Auguste Torel. The treatise occupies no less than 480 quarto pages, and is written in French.

SOCIETIES AND ACADEMIES

LONDON

Chemical Society, June 3.—Prof. Abel, F.R.S., &c., in the chair.—The following papers were read :—On the effects of pressure and cold upon the gaseous products of the distillation of carbonaceous shales, by Mr. J. T. Coleman. He finds that 1,000 cubic feet of the gas produced in such large quantities at shale oil works when submitted to pressure will give about one gallon of volatile hydrocarbons fit for improving the illuminating power of ordinary coal-gas.—On the agricultural chemistry of the tea plantations of India, by Dr. C. Brown, giving analyses of the ashes of tea and the effect of fertilisers on the growth of the plant.—On the structure and composition of certain pseudomorphic crystals having the form of orthoclase, by Mr. J. A. Phillips.—Note on the sulphates of narceine and other narceine derivatives, and On the action of organic acids and their anhydrides on the natural alkaloids, Part V., both by Mr. G. H. Beckett and Dr. C. R. A. Wright.—On the action of chlorine on pyrogallol, by Dr. J. Stenhouse and Mr. C. E. Groves ; with an appendix by Mr. Lewis, on the crystalline forms of *mairogallol*, one of the products.—On nitro-alizarin, by Mr. W. H. Perkin, F.R.S. This compound, obtained by the action of nitric acid on acetyl-alizarin, dyes fabrics mordanted with alumina of an orange colour, whilst the amido-alizarin obtained from it by reduction gives a fine purple.—On some metallic derivatives of coumarin, by Mr. R. Williamson.—On the action of dilute mineral acids on bleaching powder, by F. Kopfer.

Geological Society, May 26.—Mr. John Evans, V.P.R.S., president, in the chair.—The following communications were read :—On some peculiarities in the microscopic structure of felspars, by Mr. Frank Rutley. The observations recorded in this paper related mainly to some exceptional features in the striation of felspars from various localities, involving a consideration of the extent to which dependence may be placed on the discrimination of monoclinic and triclinic felspars by the methods usually recognised in ordinary microscopic research. Some other peculiar structural features were likewise noticed, and the effects which might be produced on polarised light by the overlap of twin lamellæ in thin sections of felspars, when cut obliquely to the planes of twinning, were also considered. The paper terminated with a list of conclusions deduced from the observations recorded. These conclusions mostly related to matters of detail ; but the general inference drawn by the author was that the present method of discriminating between monoclinic and triclinic felspars by ordinary microscopic examination answers sufficiently well for general purposes, although it is often inadequate for the determination of doubtful examples, and that such examples are of more frequent occurrence than one would at first be led to suspect.—On the Lias about Radstock, by Mr. Ralph Tate, A.L.S. In this paper the author described several sections in the Lias of the neighbourhood of Radstock, in Somersetshire, with special reference to their palæontological contents and to the question of the division of the Lias into zones in accordance with the species of Ammonites occurring in different parts of the series. He maintained that although the Lower Lias in this district only attains a thickness of twenty-four feet, this is due to poverty of sediment ; and that whilst by this means the zones are compressed, and the species of Ammonites brought almost into juxtaposition, the succession of Ammonite-life is as regular in the Radstock Lias as in the most typical districts. Much of the opposition to the doctrine of zoological zones he ascribed to erroneous discrimination of species. The paper included tables of sections and lists of fossils, with the arguments founded upon them, in support of the above opinion. A few new species were described under the names of *Trochus solitarius*, *Cryptæna affinis*, *Cardita consimilis*, and *Cardinia rugulosa*.—On the axis of a Dinosaur from the Wealden of Brook, in the Isle of Wight ; probably referable to *Iguanodon*, by Prof. H. G. Seeley, F.L.S. This perfect specimen, preserved in the Woodwardian Museum of the University of Cambridge, is 3½ inches long and 3¼ inches high. The odontoid process is anchylosed to the axis, and projects forward as in the axis of birds, so as to articulate with the occipital condyle of the skull. The pre- and postzygapophyses are situated much as in birds ; as are the two ovate pedicles, on the anterior part of the side of the vertebra to which the cervical rib was articulated. But posteriorly the articular surface for the third cervical vertebra is transversely ovate and slightly concave. The neural spine is compressed from side to side, more so in front than behind. Among mammals, the nearest resemblance to this kind of ax's is seen similarly in the whale ; and among reptiles the crocodile has a two-headed rib ; but the other characters are more like those of *Hatteria*, which the author regarded as a near ally of the Crocodilia and Chelonia, and as wrongly united with the Lacertilia.—On an Ornithosaurian from the Purbeck Limestone of Langton, near Swanage (*Doratorhynchus validus*), by Prof. H. G. Seeley, F.L.S. The author obtained these specimens (a lower jaw and a vertebra) in 1868, and described them in the "Index to the Secondary Reptilia, &c., in the Woodwardian Museum in 1869 as *Pterodactylus macrurus*. He now believed that the Ornithosaurian vertebræ from the Cambridge Greensand, which have been regarded as caudal, are really cervical, and therefore that the analogy on which this vertebra was determined to be caudal cannot be sustained ; he proposed to adopt for his species Prof. Owen's specific name *validus*, given in 1870 to a phalange of the wing finger from the same deposit. The vertebra is five inches long, relatively less expanded at the ends than similar vertebræ from the Cambridge Greensand, has strong zygapophysial processes and a minute pneumatic foramen. The lower jaw, as preserved, is 12¼ inches long. The symphysis extends for five inches, and is about one-eighth of an inch deep, and divided into two parts by a deep median groove. The teeth extended for eight inches along the jaw, and about seven or eight occurred in the space of an inch. They were directed outward in front, and became vertical behind. Where the rami are fractured behind they measure 2¼ inches from side to side.

Zoological Society, June 1.—Dr. Günther, F.R.S., V.P., in the chair.—Mr. Sclater made some remarks on the most noticeable of the animals seen by him during a recent visit to the Zoological Gardens of Rotterdam, the Hague, Amsterdam, Antwerp, and Ghent.—Mr. Sclater exhibited the typical specimen of his *Centropsar mirus* (P.Z.S. 1874, p. 175, Pl. xxvi.), and stated that on a more careful examination of it he had come to the conclusion that it was a made-up skin.—Mr. Edwin Ward exhibited the two lower canine teeth of a Hippopotamus from St. Lucia Bay, S. Africa, obtained by the Hon. C. Ellis, and supposed to be the largest ever obtained. They measured from end to end round the outer curve thirty inches.—Mr. G. E. Dobson read a paper on the genus of Insectivorous Bats named *Chalinolobus*, by Dr. Peters, and gave the descriptions of several new or little known species of this group, which he proposed to divide into two sections, *Chalinolobus* and *Glauconycteris*.—A communication was read from Mr. Henry Adams, wherein he gave the descriptions of two new land shells. These were proposed to be named respectively *Eurycratera farafanga*, found on a sandy plain in the S.W. of Madagascar, near the Farafanga River, and *Pupinopsis angasi*, from the Louisiade Archipelago, in the S.E. of New Guinea.—Mr. G. French Angas communicated the descriptions of three new species of shells from Australia, proposed to be called *Helix forrestiana*, *H. broughami*, and *Euryta braxieri*.—Mr. A. G. Butler read a paper describing several new species of Indian Heterocerous Lepidoptera.—A communication was read from Rev. O. Pickard-Cambridge on some new species of spiders of the genus *Erigone* from North America.—Mr. Herbert Druce communicated a list of the collection of Diurnal Lepidoptera made by Mr. J. J. Monteiro in Angola, with descriptions of some new species.—Mr. P. L. Sclater read a paper on several rare or little known mammals now or lately living in the Society's collection, amongst which was specially noticed an apparently new species of Muntjac, proposed to be called *Cervulus micrurus*.—A communication was read from Mr. E. L. Layard, containing notes on the birds observed by him in the Fiji Islands.—Lieut.-Col. R. H. Beddome read a paper in which he gave the descriptions of some new operculated land shells from Southern India and Ceylon. The discoveries of true *Diplomatina* in Southern India and of *Nicida* in Ceylon were alluded to as being of special interest.—Sir Victor Brooke, Bart., read some supplementary notes on African Buffaloes, in the course of which he stated that he had come to the conclusion that the West African Buffalo (*Bos pumilus*) was distinct from the East African form (*Bos æquinoctialis*).—Mr. C. G. Danford exhibited specimens of the Wild Goat (*Capra ægagrus*, Gm.), from Asia Minor, and read some notes on the distribution, habits, &c., of that species.

Royal Microscopical Society, June 2.—Mr. Charles Brooke, F.R.S., vice-president, in the chair.—Mr. J. W. Stephenson exhibited and explained a simple method which he had devised for enabling any person to measure the angle of aperture of an objective, and a number of copies of the engraved

scale employed for the purpose were placed upon the table for distribution amongst the Fellows.—Mr. Charles Stewart gave an interesting account of the results of an examination into the minute structure of *Bucephalus polymorphus*, and illustrated his observations by drawings.—Mr. Slack then at some length explained the use and management of Mr. Wenham's reflex illuminator, and pointed out the means of obviating the difficulties which were found to arise when it was used in connection with objectives of large angles.

Victoria (Philosophical) Institute, June 7.—The President in the chair. This was the ninth annual meeting, and the report showed that since last year the number of subscribing members had increased by 116, and now reached 601, two-thirds of whom were country and foreign members. Papers had been read during the session by Professors H. A. Nicholson, T. R. Birks, J. Challis, and others; and the outside demand for the publications had doubled each succeeding year since 1871. The report having been adopted, the annual address was then delivered by the Rev. Robert Main, Radcliffe Observer. The address was of three sections:—1. A sketch of most important discoveries in physics, chiefly astronomical, which have been made during the last few years. 2. A slight review of some of the assumptions in two recent publications, namely, Mill's "Essay on Theism," and Strauss's "Old and New Faith." 3. A consideration of the Atomic Philosophy in connection with Dr. Tyndall's Belfast address.

BERLIN

German Chemical Society, May 24.—W. Petrieff described the products of the decomposition by heat of dibromomalonic acid, namely an oil, C_2HBr_3, and dibromacetic acid.—W. Wisth and A. Landolt have transformed bromaniline into parabromobenzoic acid, by converting it into the corresponding mustard oil $C_6H_4Br-N=C=S$, and transforming this into the nitrale $C_6H_4Br-C\equiv N$.—A. Weber has studied mononitrodimethylaniline and monobromodimethylaniline.—M. Nencky has transformed indol into nitrosoindol-nitrate

$$C_{16}H_{13}(NO)N_2.NO_3H,$$

which sulphide ammonium converts into hydrazindol

$$(C_{16}H_{13}N-NH)_2$$

—H. Limpricht retracts his opinion of the existence of four isomeric monobromobenzenesulphonic acids, the fourth being identical with that obtained from sulphanilic acid.—F. Fittica, however, still insists upon the existence of four mononitrobenzoic acids, but makes it more improbable than ever by stating that the fourth isomeride is transformed by tin and hydrochloric acid into the body $C_{12}H_{12}N_2O$!—H. Hassenpflug has been able to convert nitrobenzene into paranitrobenzoic acid, by treating it with peroxide of manganese and sulphuric acid.—L. Klippert has studied the action of fluoride of silicium on ethylate of sodium. It results in the formation of sodium fluoride, silicium fluoride, and silicic ether.

VIENNA

Imperial Academy of Sciences, Jan. 7.—Prof. K. Puschl presented a memoir on the changes in the volume of caoutchouc by heat. The author gives as the results of his experiments, (1) that the density of caoutchouc reaches a minimum at a certain temperature; (2) that the temperature of this minimum changes according to the mechanical tension, and is the lower the greater the tension; (3) that with caoutchouc upon which no tension is applied, the temperature of the minimum of density is higher than the ordinary temperature; (4) that the reverse of this is the case with caoutchouc under strong tension.—Director von Littrow then made some communications regarding Borrelly's comet.—Prof. E. Suess presented a paper on the volcano Venda, near Padua.—Prof. Dr. Winckler then read a treatise on the integration of two linear differential equations.—Dr. Doelter gave a preliminary account of the geological nature of the Pontinic islands.—Dr. von Littrow communicated a paper on the relative capacity of different soils for conducting heat and the corresponding influence of water.—Dr. Lippmann presented a memoir on the action of iodine upon mercuric oxide. The author shows that whenever a hot solution of iodine acts upon mercuric oxide, an iodate always is formed besides the mercuric iodide, and that it is indifferent whether the solution be made in alcohol, benzine, chloride of carbon, butylic alcohol, acetone, or water.—Prof. Schlesinger then presented a memoir on a metallic barometer without mercury.

PARIS

Academy of Sciences, May 31.—M. Frémy in the chair.—The following papers were read:—Researches on sulphides, by M. A. Cahours.—A note by M. L. Saltel, on left curves.—On the alterations in the level of the Seine in the environs of Paris, from November 1874 to May 1875, by M. A. Gérardin.—On a new method of preparing highly concentrated formic acid, by means of anhydrous oxalic acid and a polyatomic alcohol, by M. Lorin.—A note by M. J. Riban, on the isomerism of the chlorohydrates $C_{10}H_{16}$. HCl.—Researches by M. E. Faivre, on the functions of the front ganglion of *Dytiscus marginalis*.—On the organisation and the natural classification of the Acarina of the Gamasea family, by M. Megnin.—Experimental researches on the toxical properties of putrefied blood, by M. V. Feltz.—On chronical aortite, by M. P. Jousset.—On a new method of treating rheumatism of the brain by chloral hydrate, by M. E. Bouchut.—On the improbability of an interior sea or lake having existed formerly on the Sahara desert, by M. Pomel.—On the influence of drought upon Cryptogamæ, by M. E. Robert.—On the origin of Phylloxera at Cognac, by M. Mouillefert.—A note by MM. Ph. Zoeller and A. Grete, on the use of xanthate of potash against Phylloxera.—A note by M. Julien, on the presence of Phylloxera in the Auvergne.—A letter from M. Villedieu, on the influence of moisture upon Phylloxera.—A letter from M. Reymonet, on the possibility of grafting vines on little trees the roots of which cannot serve as food for Phylloxera.—A letter from M. F. Moll, on the use of a mixture of soft soap and dead oil (as used for railway sleepers) against the larvæ of cockchafers and snails.—A number of communications of minor interest were then read; most of them were competition papers for the various prizes the Academy distributes annually.—Researches on the rate of magnetisation and demagnetisation of wrought-iron, steel and cast-iron, by M. M. Deprez.—A note by MM. V. de Luynes and A. Girard, on the rotatory power of crystallised sugar and on the polarimetric analysis of various sugars.—Researches on the emissive power of leaves, by M. Maquenne.—Remarks by M. A. Bechamp, concerning a note by M. Gayon, read at the meeting of April 19 last, on the spontaneous alterations in eggs.—A note by M. A. Gautier, on the production of blood fibrine.—A note by M. Grimaud de Caux, on a case of psoïtis.

BOOKS AND PAMPHLETS RECEIVED

AMERICAN.—Report of the Vertebrate Fossils discovered in New Mexico: Prof. E. D. Cope (Washington).—Eighth Annual Report of the Trustees of the Peabody Museum.—Astronomical and Meteorological Observations made during the Year 1872 at the United States Naval Observatory: Rear-Admiral B. F. Sands, U.S.N. (Washington).—Progress Report upon Geographical and Geological Explorations and Surveys West of the 100th Meridian in 1872, under the direction of Brigadier-General A. A. Humphreys, by First Lieut. George M. Wheeler; with Topographical Maps (Washington).—Religion and Science in their relation to Philosophy: Charles W. Shields, D.D. (New York: Scribner, Armstrong, and Co.).—Seventh Annual Report on the Noxious, Beneficial, and other Insects of the State of Missouri: Charles V. Riley.—Bulletin of the U.S. Geological and Geographical Survey of the Territories. No. 3, Second Series (Washington).—U.S. Geological and Geographical Survey of the Territory of Colorado: F. V. Hayden (Washington).—Third Annual Report of the Board of Managers of the Zoological Society of Philadelphia, U.S.—On the Devonian Trilobites and Molluscs of Ereré, Province of Pará, Brazil: Prof. Ch. Fred. Hartt and R. Rathbun.

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