THURSDAY, JANUARY 13, 1881

BAROMETRIC CYCLES

ABOUT twelve years ago Mr. Baxendell of Manchester gave evidence of a connection between the convection-currents of the earth and the state of the sun's surface, and the subject has since been much discussed by meteorologists from various points of view.

Amongst these Mr. Meldrum of the Mauritius Observatory has brought forward much evidence in favour of a connection between sun-spots on the one hand and rainfall and cyclones on the other. Still more recently the Indian meteorologists, including the names of Messrs. Archibald, Blanford, Broun, Charles and Frederick Chambers, Eliot, and Hill have studied with much success the abnormal variations of barometric pressure in the tropics. Of these the researches of Mr. F. Chambers are particularly interesting[1] as exhibiting a very close relation between such barometric fluctuations and the state of the sun's surface.

The chief principle underlying these investigations is sufficiently obvious. We know that the marked differences in barometric pressure which exist between various portions of the earth's surface must be due to the sun; if therefore the sun be in reality variable we should naturally expect these differences to vary likewise in such a way as to be strengthened when the sun is most powerful and weakened when he has least influence. In accordance with this way of regarding things, Mr. Chambers in 1876 pointed out that the abnormal variations of the monthly mean barometric pressure at Bombay in that year were mainly variations in the intensity of the usual seasonal movements, while in 1877 he attributed the uniformly high barometric pressure and the deficient rainfall of that year to a weak development of the equatorial belt of minimum pressure, probably induced by a diminution of the solar heat.

In a diagram attached to his first communication Mr. Chambers compares the curve of solar-spotted area with other curves denoting the barometric pressure at various widely-distributed tropical stations, from which we can clearly see that there is a very marked resemblance between the salient points of the various curves on the hypothesis that a large amount of sun-spots corresponds to a low barometer. But besides this it appears that the epochs of maximum and minimum barometric pressure lag considerably behind the corresponding epochs of minimum and maximum solar-spotted area, and that this lagging behind is greater for easterly than for westerly stations, or in other words the abnormal barometric variations in the tropics may be said to travel at a very slow rate round the earth from west to east.

Perhaps the subject of greatest practical importance in these communications is the discussion regarding Indian famines and their connection with sun-spot minima—a connection first brought to light by Dr. Hunter. Mr. Chambers sums up his conclusions on this point as follows:—

1. Variations of the solar-spotted area are succeeded months afterwards by corresponding abnormal barometric variations, a high barometer corresponding to a minimum of sun-spots.

2. Famines follow in the wake of curves of high barometric pressure.

Finally two methods are indicated by which early intimation of the approach of those meteorological disturbances which are attended by famines may possibly be obtained.

1. By regular observation of the solar-spotted area, and early reduction of the observations, so as to obtain early information of current changes going on in the sun.

2. By barometric observations at stations differing widely in longitude and the early communication of the results of stations situated to the westward.

While it thus appears that the evidence in favour of a connection between the state of the sun's surface and the meteorology of the earth is continually acccumulating it may not be amiss to review briefly the present position of the problem.

In the first place Mr. Meldrum, as already mentioned, has given evidence that in numerous stations the rainfall is greater about times of maximum than about times of minimum sun-spot frequency.

Secondly. Through his labours and those of M. Pöey we have reason to believe that there are more cyclones in the Indian Ocean and hurricanes near the West Indies during times of maximum than during times of minimum sun-spot frequency.

Thirdly. There is the connection between the barometric fluctuations of the tropics and the state of the sun's surface which has just been pointed out.

Fourthly. From investigations in which I have been recently engaged there is reason to suppose that sun-spot inequalities of short duration are followed by corresponding inequalities in the diurnal temperature range of Toronto in such a way that a large amount of sun-spots slightly precedes a large temperature range.

Fifthly. To go from meteorology to magnetism there is the well-known connection first observed by Sabine, in virtue of which the diurnal oscillations of the magnet are greatest about times of maximum sun-spots. And I may add that magnetic maxima lag behind sun-spot maxima, while there are also indications that magnetic weather, like meteorological weather, travels from west to east.

We thus perceive how strong the evidence is in favour of some connection between the state of the sun's surface and terrestrial meteorology, while at the same time it is unmistakably indicated by all elements that this connection is of such a nature as to imply that the sun is most powerful when there are most spots on his surface. Add to this that the spectroscopic observations of Lockyer and others tend in the same direction, as well as such actinometric results as we have been able to procure, chiefly through the labours of Mr. J. H. Hennessey at Dehra Dhoon and Mussoorie.

In fine this hypothesis is rapidly emerging, if indeed it has not already emerged, from the regions of mere conjecture.

But here it is necessary to bear in mind the following considerations. Prof. Stokes has pointed out that the problem before us really involves two questions, which may be stated as follows:—Firstly, do the changes which take place in the sun's surface correspond to changes in

[1] See NATURE, November 25 and December 2, 1880.

the meteorology and magnetism of the earth, and if so, does an increase of spotted area denote an increase of solar activity, or the reverse?

This question, I have already remarked, seems to be rapidly emerging from the realms of mere conjecture. But there is still another question, for we have to inquire whether these recognised solar inequalities bear all or any of the marks of a true periodicity. Now this is still *sub judice*, while at the same time it is a point of very great practical importance. For if the solar inequalities be found on investigation to present none of the marks of a true periodicity, we can hardly hope ever to be able to hazard a prediction regarding the state of the sun, and our knowledge of the eleven-yearly period, as it is called, will continue to remain very much the same as at present. But on the other hand, if we find that there are true solar periods and succeed in disentangling them, we may hope to arrive at some measure of predicting power. As I have said, this question is still unsettled, and will of course present itself in different ways to different observers. Meanwhile all we can do is to observe and register the actual state of the sun's surface, and inasmuch as the meteorological occurrences of greatest practical issue do not precede but follow solar phenomena by several months or more, we may thus arrive at a limited amount of practical prevision.

I do not however feel sure that the method of doing this which Mr. Chambers has indicated is in reality the best, for I should imagine that unexceptionable observations of the sun's intrinsic heat-giving power, if these could be obtained, would furnish a more trustworthy instrument of prevision than the sun-spot record.

Then with regard to indirect observations. No doubt those of the barometer are very immediately connected with the occurrences which we wish to foresee, but yet I think it possible that well-selected magnetic observations might ultimately be found to follow more quickly upon solar changes as well as to indicate with a less amount of local influence the true state of the sun.

These however are points that can only be settled by future research. Meanwhile it is extremely gratifying to all who take an interest in this subject to reflect that it is engrossing the attention of observers in all parts of the world.

BALFOUR STEWART

LIFE OF LIVINGSTONE

The Personal Life of David Livingstone, LL.D., D.C.L. Chiefly from his Unpublished Journals and Correspondence in the Possession of his Family. By William Garden Blaikie, D.D., LL.D., New College, Edinburgh. Portrait and Map. (London: Murray, 1880.)

WHEN the news of Livingstone's sad death on the swampy shore of Lake Bangweolo reached this country, and when his body was brought home by his faithful followers to be honoured as the nation honours its greatest and best; and again on the publication of his "Last Journals," we spoke in some detail of the great work he accomplished, and expressed our opinion as to the position which that work had earned for him. The years that have elapsed since Livingstone died at his post have only confirmed the judgment of the nation; and now that Dr. Blaikie's admirably-compiled "Personal Life" enables us to fill up the portrait, it will be seen that the man was as great as his work. Necessarily the missionary and religious side of Livingstone's character and work occupies a large place in this volume; this was to be expected from a writer who is a prominent leader in the Free Church of Scotland. But we do not think there is any excess in this direction; these were genuine and ever-present aspects of the character of the man, and Dr. Blaikie does not give them place at the expense of any other feature. He has honestly endeavoured to give us a complete portrait of his hero, and in this we think he has decidedly succeeded. Simplicity and transparency were marked features in Livingstone's character from first to last; delight in simple joys, a boyish love of fun, tenderness of heart and all-embracing charity, strong natural affection, the yearnings of which he could and did sacrifice to his still stronger sense of duty, the whole dominated by an all-conquering determination and perseverance in accomplishing the work which he believed was "given him to do." This is the impression which Dr. Blaikie's "Personal Life" gives, and in this it only confirms the impression which is conveyed by a study of Livingstone's own narratives.

Dr. Blaikie, however, tells us many things which must be new to most of those who knew Livingstone only through his works. We learn here how well qualified he was for the work which from early years he seems to have set before himself. Livingstone came of a good stock, which, though humble, knew of and had some pride in its ancestry. One ancestor fought at Culloden on the side of Prince Charlie, for on the mother's side he had some Highland blood in his veins. But the impulsive and sad temperament of the Celt was considerably modified by the practical and hopeful features of the Teutonic blood of his father. The latter was a type of the devout, rigidly honest, intelligent, and comparatively well-read, humble Scotchman, while the mother held the love and respect of her son to the end of her life. The family were poor, and all had to work hard; and early in life young Livingstone had to begin to earn his living in a cotton-mill at Blantyre, near Glasgow, where he was born March 19, 1813. With his first wages he bought a copy of Ruddiman's "Latin Rudiments," and thus early, it is evident, his aspirations went beyond the cotton-mill. His hours were long, but while attending to his "jenny," and till late at night, after his day's work was over, he conned his Ruddiman and other books to qualify himself for a University course. His thirst for reading was great, and he devoured all the books that came within his reach. Natural science also had its attractions for him, which he indulged by scouring the country when he had time in search of natural history specimens. Dr. Blaikie tells of Livingstone's "conversion" when he was a young man. This, in his case, means that what was instinctive action became thenceforth settled and conscious purpose. It was doubtless a proud day both for father and son when the former walked with the latter to Glasgow to see him settled in a humble lodging in order that he might attend the classes at Anderson's College. Livingstone never intended to be a clerical missionary; medicine was the subject of his study in Glasgow, and it was as a medical missionary he intended to accomplish the work of his life. It was only to please his friends and the

London Missionary Society he consented to "ordination." Chemistry seems to have been a favourite subject with him at college, and Dr. Blaikie narrates an interesting incident in which Livingstone and James and William (now Sir William) Thomson and Lyon Playfair met together at James Young's (now of Kelly) rooms, to witness some chemical experiment. Having been accepted by the London Missionary Society, Livingstone went to London to complete his medical studies, get some lessons in theology, and learn to preach. His failure in the latter accomplishment nearly led to his final rejection, and no doubt determined the Society to send him to the rough and humble field of Africa, instead of to China, on which his heart was set. The decision must be regarded as in every respect fortunate, though Livingstone had been some time in Africa ere he got over his disappointment. He went out to his work in Africa in 1841, and how anxious he was in every way to qualify himself for that work is shown by the fact that he got the captain of the ship in which he sailed to teach him the use of the quadrant and how to take lunars. With a few more lessons in taking observations from Sir Thomas Maclear at the Cape, he became an adept in this kind of work, and Sir Thomas afterwards expressed his astonishment at the almost perfect accuracy of Livingstone's observations in this department. He left the Cape as soon as he could and made for Moffat's station at Kuruman. Still further north he went, about 250 miles, and settled for some time among the Bechuanas, over whom, as over all other natives with whom he came into contact, he soon acquired great power and influence. His idea of a missionary's work was very practical, and rapidly developed and expanded, after he set foot in Africa. From the first he gave attention to geography, and his early letters are full of geographical details, illustrated by little sketch maps. How early his mind was attracted by the scientific questions connected with the geography of Africa will be seen from the following passage from the work before us :—

"The progress of medical and scientific work during this period is noted in a letter to Dr. Risdon Bennett, dated 30th June, 1843. In addition to full details of the missionary work, this letter enters largely into the state of disease in South Africa, and records some interesting cases, medical and surgical. Still more interesting, perhaps, is the evidence it affords of the place in Livingstone's attention which began to be occupied by three great subjects of which we shall hear much anon—Fever, Tsetse, and 'the Lake.' Fever he considered the greatest barrier to the evangelisation of Africa. Tsetse, an insect like a common fly, destroyed horses and oxen, so that many traders lost literally every ox in their team. As for the Lake, it lay somewhat beyond the outskirts of his new district, and was reported terrible for fever. He heard that Mr. Moffat intended to visit it, but he was somewhat alarmed lest his friend should suffer. It was not Moffat but Livingstone, however, that first braved the risks of that fever swamp.

"A subject of special scientific interest to the missionary during this period was—the desiccation of Africa. On this topic he addressed a long letter to Dr. Buckland in 1843, of which, considerably to his regret, no public notice appears to have been taken, and perhaps the letter never reached him. The substance of this paper may, however, be gathered from a communication subsequently made to the Royal Geographical Society (see *Journal*, vol. xxvii. p. 356) after his first impression had been confirmed by enlarged observation and discovery. Around and north of Kuruman, he had found many indications of a much larger supply of water in a former age. He ascribed the desiccation to the gradual elevation of the western part of the country. He found traces of a very large ancient river which flowed nearly north and south to a large lake, including the bed of the present Orange River; in fact he believed that the whole country south of Lake 'Ngami presented in ancient times very much the same appearance as the basin north of that lake does now, and that the southern lake disappeared when a fissure was made in the ridge through which the Orange River now proceeds to the sea. He could even indicate the spot where the river and the lake met, for some hills there had caused an eddy in which was found a mound of calcareous tufa and travertine, full of fossil bones. These fossils he was most eager to examine, in order to determine the time of the change; but on his first visit he had no time, and when he returned he was suddenly called away to visit a missionary's child, a hundred miles off. It happened that he was never in the same locality again, and had therefore no opportunity to complete his investigation."

It was not likely that a man whose mind was filled with such problems would be content to settle down to the dull routine of the work of a common missionary, and count his success by the tale of doubtful "conversions" he could send home to his constituents. He kept moving onward from one station to another, getting further and further into the interior, gaining the love of the natives and the hatred of the Boers. By his example more than by direct teaching he showed the people the beauty of right living, and taught them many industrial arts which some of them have not lost till this day. But his longing was ever northwards, and his eager desire to solve the mystery of Lake 'Ngami. It was not till 1849 however that he was able to visit the lake, and his account of the visit first brought him permanently into notice as a working geographer. This may be said to have ended the first stage of Livingstone's career, that in which the missionary was predominant. It seems to us, however, doubtful whether Livingstone ever intended definitely to settle down to the life of a missionary. Even from the beginning, we think, he must have had some vague idea of combining the function of missionary and explorer, always, however, with the one great object in view of bringing Africa under the influences of civilisation and Christianity. Shortly after the 'Ngami excursion he became a missionary at large. Returning to Cape Town, he sent home his wife and children, and prepared himself for the great work of exploring the Zambesi. Proceeding northwards to Linyanti in 1852, he set out on that ever memorable journey to Loanda and across the continent to Quilimane, which stamped him as one of the greatest explorers of all time. The story of this and of his subsequent work in the region of Lake Nyassa, and of his many years' wandering all over Central Africa, he has told himself, and Dr. Blaikie wisely refrains from introducing more of it than is really necessary to hold together the narrative of his Personal Life. All that Livingstone has done for Africa it is not easy to estimate. It is he more than any other explorer who has filled up the great white blank in the maps of our schoolboy days. His geographical instinct was surer than that of any other man; only once was it seemingly at fault, when he wandered away by Lake

Bangweolo seeking for the "fountains of the Nile"; and that one mistake cost him his life. Men like Sir Thomas Maclear, Prof. Owen, and Sir Roderick Murchison testify to the high value of his observations in various departments of science; and it is due to his example and initiative that Africa is now covered with an army of explorers. Livingstone was a man who was consumed with a definite and noble purpose, which he firmly believed it was his duty to carry out unto death. In doing so he was bound to give offence, and he did make enemies; and so must every man who is able to conceive a great purpose and possesses strength of will and energy of physique sufficient to carry it out. Had he been weakling enough to be swayed by the scruples of others he would never have left Cape Town. No great work was ever yet accomplished without sacrifice; and we have here mainly to do with the work which Livingstone accomplished for science. That work is the highest of its kind, and had Livingstone been either a Byron or a Napoleon in character, the value of that work would not have been less. Fortunately it is clear from Dr. Blaikie's pages—which consist largely of Livingstone's own journals and letters—what indeed was pretty clear before, that Livingstone was a pure and tender-hearted man, full of humanity and sympathy, simple-minded as a child, with a healthy ambition to do a great work for Africa and for science, and with energy and courage sufficient to carry it out. The motto of his life was the advice he gave to some children he addressed in a humble Scotch meeting-house when he returned from his first great journey and found himself a great man—"Fear God and work hard."

SALVADORI'S ORNITHOLOGY OF NEW GUINEA

Ornitologia della Papuasia e delle Molucche di Tommaso Salvadori. Parte prima. 1 vol. 4to. 540 pp. (Torino, 1880.)

IN the second volume of the Linnean Society's *Journal of Proceedings*, published in 1858, will be found an article by Mr. Sclater on the Birds of New Guinea, which gives in a few pages a summary of the then existing state of our acquaintance with this subject. The bulky quarto now before us, to be followed by three or four other similar volumes, is no bad evidence of the vast mass of additions that has been made to our knowledge of the Papuan avifauna since that period.

In 1857 the only modern authorities on the birds of New Guinea were the naturalists of the French circumnavigating expeditions, who had explored the vicinity of Havre Dorey in the northern peninsula of the island, and the collectors for the Leyden Museum, who had visited Lobo Bay and other points on the south coast. Although much is still wanting to complete our knowledge of the Papuan avifauna, much has been done since those days. In 1858 our famous countryman Mr. Wallace passed some months at Havre Dorey, and made excellent collections in every branch of zoology. Moreover in the neighbouring island of Batchian Mr. Wallace was fortunate enough to come across a new form of paradise bird—one of the few recent additions to this remarkable group—which was deservedly named after its discoverer, *Semioptera wallacii*. Mr. Wallace was also the first of modern explorers to visit the Arroo Islands—which belong strictly to the same fauna as New Guinea, and in his well-known work on his "Travels in the Malay Archipelago" has given us a most interesting account of the habits of the paradise birds as there observed, and of the manner in which the natives procure their specimens.

After Mr. Wallace the Italian travellers D'Albertis and Beccari were the next to visit New Guinea, and succeeded in carrying their investigations further into the unknown interior than it had been hitherto believed possible to penetrate. The ascent of the Arfak Mountains was first accomplished by D'Albertis in 1872, and Beccari succeeded in making the same dangerous journey some years later, besides visiting many localities on the north coast which had not been previously explored. Both these naturalists were active collectors of birds, and transmitted large collections to Europe. In 1875 and the following year D'Albertis turned his attention to the southern portion of New Guinea, and during his excursions up the Fly River made fresh additions to our knowledge of Papuan ornithology. In the meantime a German naturalist, Dr. A. B. Meyer of Dresden, was engaged on new explorations on the shores of the great Bay of Geelvinck, and did not fail to make considerable additions to the rich avifauna of that district.

While Prof. Salvadori has not neglected to consult every existing authority on Papuan ornithology, and, we believe, to visit every European museum which contains specimens from the Papuan region, it is mainly upon the large series accumulated by his countrymen D'Albertis and Beccari, to which must be added the numerous specimens obtained by the hunters of Heer A. A. Bruijn of Ternate, that his present labour is based. These collections, or at any rate all the important portions of them, have passed into the Museo Civico of Genoa, either through the liberality of the Marquis G. Doria, the founder of that institution, or through assistance given by the Italian Government. Their extent may be judged of from the fact, stated in the preface to the present volume, that they contained no less than 9539 specimens, which have thus come directly under Prof. Salvadori's observation, besides the examples examined in the Museums of Paris, London, Leyden, Bremen, Berlin, Dresden, and Vienna, which, as already stated, our author has visited for the purpose of preparing his work. It is evident therefore that materials did not lack, and Prof. Salvadori's well-known abilities as an ornithologist give us every confidence that these materials will have been well used.

Such indeed is doubtless the fact. If the succeeding volumes of the "Ornitologia della Papuasia" shall be executed in the same style as that in which the first volume has been prepared, there can be no question that a most important work will have been accomplished. Not only is every species fully and accurately described, but its complete synonymy is given, a detailed list of the specimens from various localities and remarks on their differences are added, and, in fine, every necessary particular is given that can contribute to a perfect history of the species. Would that other geographical works on ornithology were carried out with equal exactness and similar strict attention to details!

In conclusion we have only to express our thanks to

Prof. Salvadori for the admirable way in which he has commenced his laborious task, and to express our hope that he may bring it to a successful conclusion. In Mr. Gould's great work on the "Birds of New Guinea" we have a series of magnificent illustrations of all the more remarkable forms of Papuan ornithology. Such a work as that of Prof. Salvadori's was much wanted in order to perfect our knowledge of the history and literature of this attractive subject.

OUR BOOK SHELF

An Elementary Treatise on the Integral Calculus, containing Applications to Plane Curves and Surfaces; with numerous Examples. By B. Williamson, F.R.S. (London: Longmans, 1880.)

OF a *third* edition we need only remark that it is a carefully revised issue of the second, and point out the few important additions that have been made. In the discussion of Frullani's theorem (§ 119), a simple shape of the formulæ, due to Mr. E. B. Elliott, is given, and reference made to other articles on multiple definite integrals by the same gentleman (and by Mr. Leudesdorf) in the *Educational Times* (1875) and in the *Proceedings* of the London Mathematical Society, 1876-7. A new article (119*a*) gives a proof of a simple character, by Zolotareff, of the remainder in Lagrange's series. § 147 contains a remarkable extension of Holditch's theorem, due to Mr. Elliott (*Mess. of Math.* February, 1878), and § 147*a* gives the "singularly elegant" theorem discussed by Mr. Kempe (*Mess. of Math.* July, 1878), to which reference is made in Prof. Minchin's letter in NATURE (December 23, 1880), in which he proves these theorems from other considerations. Various insertions of a minor character increase the volume by more than twenty pages. A good feature of the present edition is an index at the end of the work.

Botanisches Centralblatt. Herausgegeben von Dr. O. Uhlworm. Band i., Quart. 1-4. (Cassel: Fischer, 1880.)

WE are now able to record the completion of the first volume of this valuable serial, a monument of extraordinary energy on the part of the editor and his band of assistants. The aim of the publication is to give an abstract or *résumé* of every important contribution to botanical science published in the scientific serials of the Continent of Europe, Great Britain, and America; and, as far as we have been able to judge, the undertaking has been carried out with great judgment and completeness. Original works are also not neglected. Appearing much more promptly than Just's "Jahrbücher," the "Centralblatt" is indispensable to any one who desires to keep abreast of any department of botanical science.

Botany for Children: an Illustrated Elementary Text-Book for Junior Classes and Young Children. By the Rev. George Henslow, M.A., F.L.S., &c. (London; Edward Stanford, 1880.)

WE do not think that botany can be taught with advantage to children from books. No method of teaching seems so well adapted to the wants of junior students as that of demonstration. A flower pulled to pieces by the student and the parts and their importance intelligently explained by the teacher forms a lesson far more valuable than any to be got from a text-book. With a few such demonstrations from easily-obtained flowers, taken as they present themselves, most of the elementary facts regarding flowering plants can be readily mastered, while the habits of observation and the facility of dissecting thus obtained are invaluable to the student. It is, we fear, too much the habit in teaching botany to make the student prepare a lesson from the text-book as if it were spelling or history. This is really what should be most carefully avoided, although there must be a great temptation to proceed with the book lesson when the plant is not obtainable. Mr. Henslow states in his preface: "The descriptions of flowers in this book are intended to form botanical reading-lessons, specimens of the flowers being at the same time placed in the hands of the pupils, who are required to dissect and examine them carefully, and be sure they see and understand each special part noticed in the text." When used in accordance with the directions laid down by the author, the book seems an excellent one, and calculated to serve its purpose well, although some very important types have been omitted for want of space. As we have known children to work out the structure of flowers for themselves by means of this little book and to enjoy the exercise, we believe the work will be deservedly popular. The illustrations are rather coarse, but on the whole characteristic and often give details of structure sometimes omitted from much larger works.

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.*

The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

Geological Climates

I NOW proceed to justify my statement, which has caused Mr. Wallace great surprise, viz.:—

"It is impossible to suggest any rearrangement of land and water which shall sensibly raise the temperature of the west of Europe, or sensibly depress the temperature of the east of North America."

It is proverbially difficult to prove a negative, and the only way to do so in this case is to show that any given redistribution of land and water is incapable of producing the effects ascribed to it.

I have already shown that Mr. Gardner's proposed redistribution by means of a land connection between Greenland and Europe would fail to benefit the west of Europe. In like manner I shall now demonstrate that Mr. Wallace's redistribution of land and water is quite inadequate to raise the temperature of the west of Europe.

Mr. Wallace's proposal is to introduce two new Gulf Streams into the Arctic Ocean, in addition to the present Gulf Stream.

1. The first of these additional Gulf Streams would be the Kuro-siwo, admitted through a widened Behring's Strait, the effect of which, he estimates, would be *to prevent altogether the formation of ice in the Arctic Sea.*

2. The second additional Gulf Stream is provided by allowing the waters of the Bay of Bengal and of the Arabian Sea an outlet to the north through the Caspian depression into the Arctic Ocean. The effect of this second Gulf Stream, he estimates, would be *to raise the temperature of the Polar ocean from 15° F. to 20° F. above the freezing point of water.*

This mode of raising the temperature of the Arctic regions, so as to allow of the growth of their Miocene flora, occurred to me when speculating on the former high temperatures of these latitudes, but I rejected it as inadequate to account for the change of climate required for the following reasons. But before giving these reasons I wish to add that Mr. Wallace has given two precise statements involving quantitative results, without giving the numerical grounds on which he made those statements.

The following are the grounds on which I deny the adequacy of Mr. Wallace's causes of change of climate:—

(*a*) *Air and Water.*—Warm winds and cold winds are in themselves of little consequence in influencing climate, except they blow over a large expanse of warm or cold water; they are in fact only heat and cold carriers for the water. The specific heat of water is more than four times that of air, and water is 815 times heavier, bulk for bulk; therefore one cubic mile of water will contain as much heat as 3260 cubic miles of air at the same

temperature. From this it follows that the temperature of the air at the surface of the sea corresponds with the surface-temperature of the water. This has been fully confirmed by observations made in every latitude, which show that the difference of temperature between the air and sea is never more than one or two degrees Fahrenheit.

(*b*) *Gulf Stream.*—The temperature of the air above the Gulf Stream is:—

62° F.	at latitude	40°	...	45° F.	at latitude 60°
53 ,,	,,	50°	...	35 ,,	,, 70°

and the quantities of water contained in the Gulf Stream are:—

36	cubic miles per hour	at	latitude	50°
36	,,	,,	,,	60°
24	,,	,,	,,	70°

The mean annual temperatures of the several latitudes, in the northern hemisphere, are, taken all round the globe—

29 3° F.	at latitude	60°	...	4·5° F.	at latitude 80°
14·4 ,,	,,	70°	...	0·0 ,,	,, 90°

From this it is evident that the Gulf Stream is inadequate to keep the temperature of the Polar cap, from the Pole to 60° lat., above the freezing-point of water; so that if the heat and cold were uniformly distributed, the whole of this great area would be permanently frozen over, the thickness of the ice being greatest at the Pole, and least at lat. 60°.

This ideal ice-cap (on the supposition of uniformly distributed heat and cold) represents accurately the amount of heat that must be introduced into the Arctic regions before their temperature rises to that of the freezing point of water. Its southern limit is lat 58° 51′, where the mean annual temperature all round the globe is 32° F.

The thickness of this ideal ice-cap at the Pole is unknown, but from what we know of the palæocrystic ice of Bank's Land and Grinnel Land must be measured by hundreds of feet; and its mean temperature must be at least 20° F. below the freezing point of water.

Mr. Wallace has put forward the supposition that the introduction of an equal proportion of the Kuro-siwo (to that of the Gulf Stream) would prevent the formation of sea-ice in the Arctic Sea. Before this could happen, the Kuro-siwo must first melt the ice-cap, and then keep it from freezing again.

To show how inadequate this supposition is, I shall calculate what the Gulf Stream has already done, and then show what the Kuro-siwo could do.

Let us suppose that the whole heat of the Gulf Stream, passing northwards through the parallel of 70° N., is employed in melting a supplementary ice-cap extending from the Pole to 70° N. and that this supplementary ice-cap is at the temperature of 32° F. only (*mere ice-sludge*); I find the thickness of ice melted is only 5·874 feet[1] yearly.

If therefore the Gulf Stream were cut off by a barrier at 70° N. lat. an additional growth of ice at 32° F. less than 6 feet thick might grow upon the area from the Pole to 70° N. lat.

Of course the Gulf Stream expends its heat in melting local ice in the Spitzbergen and Barentz Seas, and perhaps still further east in summer along the Siberian coast, and not in melting the supplemental ice-cap I have imagined; nevertheless the whole work done by it does not exceed the melting of the ice-cap from the Pole to 70° lat., and of a uniform thickness of 5·874 feet. In other words, the work done by the Gulf Stream north of 70° lat. is equivalent to the melting of 4382 cubic miles of ice at 32° F., which represents a definite quantity of heat. It is however much easier to conceive the ice-cap from the Pole to 70° lat., of 5·874 feet thick, than 4382 cubic miles of ice.

As the ice melted between the Pole and 70° lat. has a temperature of 6° F., instead of 32° F., it is easy to see that the thickness of ice-cap melted by the Gulf Stream is 4·813 feet instead of 5·874 feet.

(*c*) *The Kuro-siwo admitted through Behring's Strait.*—Mr. Wallace quotes me as stating that the volume of the Kuro-siwo is 2½ times the volume of the Gulf Stream: I believe it to be so, but in the present discussion shall consider it to be only twice as great; for at least one-fifth of it obtains partial entrance into Behring's Strait, and behaves like the Gulf Stream; as appears from the lesser rigour of the climate of the Parry Islands, from the open water discovered by Collinson along the northern coast of America, and from the return cold current of the coast of China.

From the calculations I have just given it appears that the Kuro-siwo current admitted through a widened Behring's Strait would be competent to melt a thickness of ice-cap extending from the Pole to 70° lat., amounting to 9·626 feet.

I shall leave your readers to judge whether this amount of ice-melting justifies Mr. Wallace in asking "Suppose that only an equal proportion (to that of the Gulf Stream) of the Kuro-siwo entered the Arctic Ocean, is it not probable that no sea-ice at all would form there?"

To me this question appears like a proposal to Hercules to clean out the Augæan stables with a teaspoon.

(*d*) Let us now add on the *Mozambique Current*, converted into a *Caspian depression Gulf Stream*. Of this current I cannot allow Mr. Wallace to appropriate more than half, unless he shows cause for a land barrier preventing the other half from continuing its present course into the southern hemisphere, there to aid in mitigating the climates of the Temperate and Antarctic zones.

The *Caspian Gulf Stream* will then cut off another slice of 3·609 feet in thickness from the ice-cap extending to 70° lat. Is this amount of ice-melting sufficient to perform the feat assigned to it by Mr. Wallace of "raising the former [the Polar sea] to perhaps 15° or 20° F. above the freezing point"?

(*e*) If there be any truth at all in the power of Gulf Streams to modify the climates of the Temperate and Polar zones, the southern hemisphere should be warmer than the northern hemisphere, as it receives three Gulf Streams instead of 1½ Gulf Streams (without discussing their relative volumes).

This is the actual fact, as is easily proved, notwithstanding the iterated parrot-like statements to the contrary copied from text-book to text-book.

I have shown that, taking the annual mean temperature at all longitudes, the cold of the northern hemisphere is represented by an ideal ice-cap which is thickest at the north pole and terminates in the latitude 58° 51′ N., where the mean annual temperature is 32° F.

In the southern hemisphere, the latitude at which the mean annual temperature for all longitudes is 32° F., is found at 62° 41′ S. This limit of the ideal southern ice-cap (measuring the Antarctic amount of cold) lies nearer to the South Pole by 3° 50′, or 230 geographical miles, than the corresponding limit of the northern ice-cap from the North Pole.

These limits of ideal ice-cap at the North and South Poles are independent of the wholly different question as to which of the Poles has the largest volume of ice surrounding it, into which I shall not enter at present.

(*f*) From what I have proved above it is evident that the two return compensating currents from the Arctic seas will still consist of ice-cold water, one of which, on the coast of Asia, of double the volume of the Labrador current, will reduce the climate of China and Northern Japan to a condition compared with which the present climate of Hudson's Bay would be a Garden of Eden; and the other would bring the Ural range and Eastern Europe into the present condition of Labrador. I think it is evident, under these latter conditions, that Bournemouth would suffer, and not gain, by Mr. Wallace's arrangements of land and water. The services rendered to the Arctic lands by the two new Gulf Streams would, in my opinion, be dearly purchased by the damage done by their compensating currents in the sub-tropical latitudes of Eastern Asia and Eastern Europe.

SAML. HAUGHTON

Trinity College, Dublin, December 31, 1880

[1] I assume the following data:—Area from Pole to 70° lat. = 4,476,200 sq. gr. m.; latent heat of ice-cold water = 144° F.; Gulf Stream = 24 cub. miles per hour; temperature = 35°¼F.

IN NATURE, vol. xxiii. p. 169, Mr. Ingram mentions the growth of *Bambusa metaké* in Leicestershire. I have found large varieties of bamboo cultivated on a great scale in Northern Nippon, where the winter temperature is certainly much colder than in England. The northernmost place where I found them was the vicinity of Yokobori, about 39° 12′ N., at a small distance (twenty-five miles) from the west coast. The nearest place to the south where observations were made is Niigata, 37° 55′, and to the north Hakodate, 41° 46′. The coldest month has a temperature respectively of 33°·0 and 27°·3 F. Yusawa being situated about 450 feet high, and in the interior, the coldest month there must have not over 30°, and a heavy snowfall is the rule every winter. Again, on descending the dividing ridge

between Jukussina and Yonesawa, I first found large bamboo plantations near the last place, about 1000 feet above sea-level, and 37° 55′ N. Between here and Niigata the temperature of the coldest month must differ by about 3°, the latter place being situated near the sea. This gives about 30° F. for Yonesawa, or about the same as at Yusawa. Now in Great Britain, the mountainous districts excepted, the mean temperature of the coldest month is nowhere lower than 36°. A. WOEIKOF

St. Petersburg, December 19, 1880

IN my letter (vol. xxiii. p. 194) I inadvertently stated that Sequoia cones were composed of from 16 to 20 scales. I intended to say 16 to 50, which appears to be the maximum number in either of the existing species. J. S. G.

Chalk

THE objections urged by Mr. S. N. Carvalho, jun. (vol. xxiii. p. 194), to Wallace's explanation of the deposition of chalk must have occurred to every geological reader of "Island Life." There are very many other objections to it, and I trust to be permitted to call attention to them in the *Geological Magazine*, as they are probably too purely geological to interest the readers of NATURE.

J. S. G.

Average Height of Barometer in London

IT was stated in your "Meteorological Notes" a week or two ago in regard to the paper by Mr. H. S. Eaton on the average height of the barometer in London, that "the series is sufficiently extended as to entitle it to be considered one of the most valuable we possess in dealing with questions of secular meteorological variation."

Regarding it in the same light I have thought it worth while to apply Mr. Meldrum's method for discovering the existence and character of the secular variation in the sun-spot cycle. Taking the period 1811-79 I find the following figures for the mean cycles:—

LONDON

Annual Barometric Abnormals, Mean Cycles

	Maximum years in fifth line.		Maximum years in seventh line.	
	Pressure (1811-77).	Sun-spots (1811-77).	Pressure (1816-79).	Sun-spots (1816-72).
1.	+0·006	−33·9	−0·005	+23·3
2.	+ ·016	−23·4	− ·001	+14·5
3.	+ ·013	0·0	− ·001	+ 4·8
4.	− ·002	+28·2	− ·003	− 5·6
5.	− ·010	+43·1	− ·005	−19·0
6.	− ·011	+34·2	− ·001	−32·5
7.	− ·007	+16·8	± ·000	−37·1
8.	+ ·001	+ 0·2	+ ·011	−25·4
9.	± ·000	−14·2	+ ·021	+ 1·8
10.	+ ·001	−24·2	+ ·010	+30·9
11.	± ·000	−26·3	− ·003	+44·8

The variation of pressure, though not so regular as that I worked out for St. Petersburg in 1879, is of an almost exactly opposite character, the minimum pressure appearing as in India, about the time of maximum sun-spot, and the maximum pressure lagging two years behind the epoch of minimum sun-spot. These results agree with the known annual rainfall variation in the same cycle, which is likewise similar in character to that which occurs in the tropics. I would suggest that the marked difference between the results for London and St. Petersburg possibly arises from the close communication between England and the tropics through the medium of Atlantic oceanic and atmospheric currents. E. DOUGLAS ARCHIBALD

January 4

Experiments with Vacuum Tubes

IN my letter published in the last number of NATURE I omitted to say that we have compared vacuum tubes without electrodes with a tube containing water. A tube was filled about nine-tenths full of water and then sealed hermetically. It was then applied to the prime conductor of the electric machine and electrified in the same way as the vacuum-tubes without electrodes, and it was found to behave precisely as they did. The water tube became charged as a double Leyden jar, positive outside and negative inside at the end next the prime conductor, and negative outside and positive inside at the other end. A great tendency to rupture of the glass was also observed. So far as we have been able to see the most perfect vacuum that I have been able to obtain with the Sprengel pump has behaved as to frictional electricity precisely as a perfect conductor such as water.

These experiments seem interesting in connection with the discoveries of Mr. Crookes as to the properties of a very perfect vacuum. No doubt it was known that flashes can be obtained within vacuum tubes without electrodes; but the properties of a perfect vacuum as a conductor of electricity has not been hitherto sufficiently investigated. J. T. BOTTOMLEY

Physical Laboratory, the University, Glasgow, January 8

Oxidation of Quinine, &c.

IN the Chemical Society's *Journal* for December, 1880, there is an abstract of a paper by Hoogewerf and Van Dorp, published in *Liebig's Annalen*, cciv. 84-118, in which the authors describe experiments on the oxidation of quinine, quinidine, cinchonine, and cinchonidine. As reference is made in this paper to our work upon the same subject in such a manner as to lead to the inference that we had copied Hoogewerf and Van Dorp, we beg to call attention to the dates of publication of the various memoirs relating to the matter.

In the Berlin *Berichte*, x. 1936 (close of 1877), Hoogewerf and Van Dorp published a preliminary note on the oxidation of aniline, toluidine, and quinine, and stated that they had obtained amongst other products of oxidation of quinine a nitrogenous acid, to which apparently they attached little importance. Of this acid they gave no further account. At that time we were working at the same subject, and had come to some important conclusions.

As Hoogewerf and Van Dorp's results contained nothing relating to quinine in addition to what had been observed by Cloëz and Guignet many years previously, we did not consider that they were entitled to claim that this field of work should be reserved for them. We therefore sent our paper to the Chemical Society, before which it was read on January 19, 1878 (see also Berlin *Berichte*, xi. 324). In this paper we stated that the acid obtained by us from quinine was probably identical with dicarbopyridenic acid. That the acid was a pyridenic acid we had no doubt, but owing to the difficulty of purification we had not been able to establish its formula with certainty.

In the Berlin *Berichte*, xii. 158-161, was published a second paper by Hoogewerf and Van Dorp (read before the Berlin Chemical Society on January 27, 1879), on the acid obtained from quinine, giving no analyses, but stating that the acid was *tri-* and not *di*carbopyridenic acid, thus confirming our result in its important bearing, viz. the connection between the quinine and pyridine series. In the same paper they suggested that an acid obtained by them from quinidine and cinchonine was identical with the quinine acid.

Immediately on receipt of the number of the Berlin *Berichte* containing Hoogewerf and Van Dorp's paper, we forwarded to the secretary of the Chemical Society our second memoir, which contained numerous analyses of the acid obtained, not from quinine only, but also from the allied alkaloids, quinidine, cinchonine, and cinchonidine, together with a full description and analysis of all its important salts. That paper was read before the Society on February 20, 1879.

In *Liebig's Annalen*, cciv. 84-118 (July 31, 1880), or a year and a half after the publication of our second paper, Hoogewerf and Van Dorp published analyses of the acid and many of its salts, prepared from three alkaloids, the results confirming our own in all points.

Our claim, which the above dates fully substantiate, is to have been the first to establish the connection between the quinine and pyridine series, and to have proved that the four alkaloids all gave the same oxidation product.

Prof. Butlerow of St. Petersburg, immediately on appearance of our first paper, when engaging in work closely connected with, but not overlapping ours, wrote suggesting that we should

each confine himself to his own branch, at the same time recognising the importance of our discovery; and Herr König, in a paper published in the *Berichte*, xii. 97, referring to our first paper, says: "Es ist der erste glatte Uebergang der China-alkaloïde in eine jedenfalls einfachere Substanz—das Pyridin."

WILLIAM RAMSAY
JAMES J. DOBBIE

Glasgow University

The Temperature of the Breath

DR. DUDGEON'S first letter under this heading contained the suggestion of a friend that his enigmatical thermometric readings were to be accounted for by the high temperature "caused by the condensation of the moisture of the breath by the silk handkerchief." The discussion that followed has not only brought us back to this solution, but has also furnished us with an authoritative expression of opinion that the clinical thermometer is not sensitive to pressure. F. J. M.-P. first hinted the contrary proposition only to have it thrust aside by Dr. Dudgeon with blunt denial, neglected by Dr. Roberts, and finally discarded by himself for no other apparent reason than that aqueous vapour in condensing liberates heat. Yet I venture to assert that readings as high as any obtainable by Dr. Dudgeon's method, less the pressure, can be obtained by a very similar mode of experimenting, without the developed heat: 1. If the bulb of a thermometer, protected by paper or other non-conductor, be squeezed in an intermittent manner between finger and thumb, it will be found that the mercury can readily be made to dance up and down through about a degree on the scale with a celerity not attributable to changes of temperature. 2. If eighteen inches of cotton thread be tightly wound about the bulb, on immersing the thermometer in water it will exaggerate the temperature sometimes by as many as 12° F. 3. If a tube filled with cacao butter be substituted for the thermometer the butter beneath the thread will be longer in melting than that in other portions of the tube, a result which I think proves that the high readings of experiment No. 2 are not temperature, but (in the light of No. 1) pressure readings.

My chief object in writing is to protest on general grounds against the treatment accorded to F. J. M. P.'s suggestion, but at the same time I wish to express my opinion that Dr. Roberts' argument would have been strengthened by giving heed to it, for I see nothing in *his account* of the interrupted experiment not explainable on the pressure hypothesis alone, the descending series of readings being perchance due to a yielding of the wrappings under prolonged tension. On the other hand I have to thank this omission on Dr. Roberts' part for having induced me to test the subject for myself, and thus experience, in repeating his experiment, the rare pleasure of scientific surprise at seeing the index mount higher and higher above the level of my expectations under conditions which left no doubt as to the cause being a rise of temperature. Dr. Dudgeon has done good service by directing attention to a simple experiment which, properly interpreted, throws new light on the philosophy of clothes, and should prove a telling shaft in the quiver of popular science.

WM. MCLAURIN

Islington, December 26, 1880

IN the number of NATURE which reached Madras after the departure of the mail conveying my letter of the 9th inst., I was glad to read Dr. W. Roberts' abundantly full and lucid explanation of the heat produced by breathing on thermometers enveloped in hygroscopic substances. He has, by a very simple method, confirmed the view endorsed in my communication in NATURE, vol. xxiii. p. 534.

That the effects of friction and of compression of air are so slight that they may be disregarded, has been proved; and the rise has been clearly traced to absorption of aqueous vapour. It has yet to be determined how much of this heat may be accounted for by the reduction of aqueous vapour to the fluid state, and how much by capillary action and absorption of water, with or without chemical union, and its reduction to the solid state—all of which may be included in hygroscopic action. This determination would involve some intricate investigations which some scientific specialist may perhaps find leisure to undertake. That more than simple vapour condensation is concerned in the production of hygroscopic heat is shown by the rise of temperature on adding water to a non-saturated hygroscopic substance.

A scientific colleague has suggested to me that some cases of very high axillary temperatures may be explained by the clothing of patients being pressed into the axilla in contact with the thermometer. Thus, by folding a banian round a thermometer placed in the axilla, I registered a temperature above 100° F., while the temperature in the bare axilla was 98·3. It is evident that recently changed and dried clothing and clothing warmed by the body of a non-perspiring fever patient would have still more effect when pressed closely into a hot and moist axilla. Although this point is important mainly to physicians, I venture to draw attention to it through your columns on account of its connection with the subject of hygroscopic heat.

C. J. MCNALLY

Madras, December 16, 1880

Distance of Clouds

I HAVE conveniently determined the distance of passing clouds by a method probably not new, but which I have not seen described.

It consists in ascertaining the velocity with which the shadow of a cloud traverses level ground, which is easily observed, and of course gives the velocity of the cloud itself.

The angular motion per second of clouds passing overhead is simultaneously observed by means of a coarse micrometer in a telescope, or with a theodolite.

The distance is thus obtained with fair approximation.

Distance $= \frac{v\,t\,3438}{n}$, v being the velocity in feet per second, and n the number of minutes of arc described in t seconds.

A distant mirror may be advantageously used in determining the velocity of the shadow.

EDWIN CLARK

Fluke in Calves

CAN any of your readers account for the following facts?—An examination of the liver of some six-weeks-old calves which had never touched any food but their mother's milk showed them to be infested with fully-developed Fluke (*Distoma hepatica*). It is clear that the presence of these flukes does not admit of the usual explanation, viz., the ingestion with green food or water of mollusca bearing the larva in one of its earlier stages.

I should be grateful if any of your readers could suggest an explanation of the mode in which the fluke entered the liver of the calf. Is it possible that the larva may have passed into the milk of the mother, and so have entered the stomach of the calf?

It may interest some of your readers to know that traces of fluke were present in the livers of cattle lately killed when in high condition. The fluke had apparently been established in the liver some considerable time previous to the slaughter of the animals, and had perished on their attaining to a state of high health and vigour.

A. B.

JOHN STENHOUSE, LL.D., F.R.S.

IN the early morning of the last day of the old year we lost one of the few surviving founders of the Chemical Society, Dr. John Stenhouse. He was born at Glasgow, October 21, 1809, the son of William Stenhouse of the well-known firm of calico-printers, John Stenhouse and Co. of Barrhead. He was educated first at the Grammar School and then at the University of Glasgow, and long resided in his native city. At an early age he turned his attention to chemistry, and diligently studied that science under Graham and Thomson, and subsequently with Liebig at the University of Giessen. When he removed to London, after the failure of the Western Bank of Scotland had deprived him of the fortune bequeathed to him by his father, he became Lecturer on Chemistry in St. Bartholomew's Hospital, London, but was obliged to resign that appointment in 1857 owing to a severe attack of paralysis. Even this affliction however did not discourage him, and after the lapse of a short time he renewed his scientific labours. In 1865 he succeeded Dr.

Hofmann as non-resident Assayer to the Royal Mint, but was deprived of the appointment by Mr. R. Lowe, who abolished the office in 1870.

A pupil of Graham and Liebig, he had all their enthusiasm for scientific investigation, and devoted nearly the whole of his time to research work in the domain of organic chemistry: the eminence he attained in this branch of science is fully recognised, but his contributions to our technical knowledge are not so well known. He was the author of many ingenious and useful inventions in relation to dyeing, sugar manufacture, tanning, &c., but the greatest and most permanent has been the application of charcoal for disinfecting and deodorising purposes, which took the form of charcoal air-filters for the ventilation of sewers, and the charcoal respirator, the best of all respirators, not only for preventing the deleterious effects of noxious gases in numerous manufacturing operations, but also for the protection of those subject to bronchitis, asthma, and other similar diseases.

It is impossible in our limited space to give even an outline of the numerous investigations which he published during his long scientific career, extending as it did over a space of more than forty years. The results are embodied in about 100 papers, published in various scientific journals, English and foreign; they relate in great part to what may truly be called "organic chemistry"—the chemistry of carbon compounds formed by organised bodies. John Stenhouse was LL.D. of Aberdeen; a Fellow of the Royal Society, which awarded him the Royal Medal in 1871; one of the founders of the Chemical Society; and a Fellow of the recently-established Institute of Chemistry. Of his personal character those who knew him intimately could never speak too highly; his death will be felt and mourned not only by his many personal friends, but also by men of science throughout Europe.

WILHELM HEINTZ

WE recently recorded the death, at Halle, on December 1, of Prof. W. Heintz, one of the leading German chemists of our day. He was born at Berlin, November 4, 1817. His earlier university studies were undertaken with a view of becoming a pharmacist, but this intention was relinquished as the attractions of a more purely scientific career were offered to him. In 1844 he received the doctor's degree at the Berlin University, and two years later he was admitted as privat-docent in the philosophical faculty of the same university. In 1850 he accepted a call to Halle as the successor of the well-known Marschand; and here, after passing five years as an extraordinary professor, he was appointed in 1855 to the full professorship of chemistry, and the directorship of the newly-built laboratory, posts which he occupied at the time of his death.

As a teacher and as a guide to students inclined towards chemical research, Prof. Heintz evinced more than ordinary capacity, and for a quarter of a century he has ably maintained the reputation of Halle among the centres of chemical interest in Germany. This reputation is due in no small part to his own personal contributions as an investigator; for few chemists of our day have manifested such unwearied energy and long-continued application, such thoroughness of work, accuracy of observation, and widespread familiarity with fact and theory as are evinced in Heintz's manifold and diversified researches.

The earlier portion of his career was directed to the solution of problems in physiological chemistry. Among his more important researches in this direction mention should be made of those on the juice of the *Galactodendron* (1845), on kreatin and kreatinin (1847), on lactic acid in the gastric juice (1849), on the composition of bones, and on cholesterin (1850), on the colouring matter of gall stones (1851), on urinary sediments (1862), and more especially on the animal and vegetable fats. This latter research, extending over a period of about seven years, includes exhaustive studies on the physical properties of the fats, methods of their separation, their chemical constitution and nature, the products of their decomposition, &c. His careful observations of the melting points and composition of the fatty acids in the pure state and when mixed with each other, form essentially the basis of our present knowledge on this subject, and enabled him at the time to show the composite character of various fats which preceding chemists had regarded as pure compounds.

In analytical chemistry Heintz devised a variety of methods and modifications of methods, amongst which mention may be made of his contributions on the estimation of sulphur in organic bodies, on the separation of magnesia from the alkalies, on the analysis of ashes (1847), on the determination of urea and uric acid, on the detection of gall (1848), on the determination of nitrogen (1851), on the estimation of phosphoric acid, and numerous analytical data.

In inorganic chemistry his researches were chiefly confined to studies on a variety of phosphates, on bismuth and uranium salts, on the preparation of cæsium and rubidium compounds (1865), on the combustion of ammonia in oxygen (1864), on the silicates of the alkaline metals, and to the examination of the minerals margarite, stassfurtite, carnallite, aluminite, and boracite, the latter of which he prepared artificially (1860).

It is however in the field of pure organic chemistry that Heintz's discoveries have been most numerous and important. They commence with his investigation on saccharic acid, begun in 1844 and resumed in 1858-1860, to which we owe a great measure of our knowledge of this acid, and especially of its salts and ethers. This was followed in 1856 by a study on the action of chloride of sulphur on the salts of organic acids, in which he recorded the unvarying and simultaneous formation of chlorides and sulphates at the expense of the organic salts. In 1859 he began his extensive research on glycollic acid, which occupied much of his time until 1872, by exposing monochloracetic acid to the action of various sodium alcoholates, obtaining thereby the different ethers of glycollic acid; thus with sodium ethylate:

$$CH_2Cl.COOH + NaOC_2H_5 = NaCl + \begin{matrix} CH_2.OC_2H_5 \\ | \\ COOH \end{matrix}.$$

By means of this prolific reaction he obtained a number of interesting derivatives of the acid in question. Closely allied to them were the acid ethers of glycollic acid, obtained by submitting monochloracetic ethers to the action of salts, or by acting upon glycollic ethers with such bodies as phosgene or chlorocarbonic ether. Among the other important compounds discovered by him in this group are glycolamide, glycol-ethyl-amide, diglycollic acid—$O(CH_2.COOH)_2$—obtained by the action of sodium hydrate on monochloracetic acid, diglycoll-diamide, diglycollamic acid, &c. During this same period he made noteworthy investigations on the ethyl-amines, on sulphocyan-acetic acid and its derivatives, on nitrate of ethyl, on ethyl-hydantoïn, on lactic acids, and on the amido-acids obtained from chloropropionic and iodopropionic acids by the action of ammonia. With 1874 commences his last important research—that on the aceton bases, the simplest of which result from the action of ammonia on aceton. While forced to overcome manifold difficulties in the prosecution of this investigation, Heintz succeeded in isolating a number of novel and important compounds, especially interesting from a theoretical point of view. The leading forms embraced in this new group are diacetonamine, triacetonamine; the corresponding alcohol bases diaceton-alcamine and

triaceton-alcamine ; benzal-diacetonamine ; amido-trimethyl-oxybutyro-nitrile resulting from the action of prussic acid on diacetonamine ; and amido-dimethyl-acetic acid, obtained by the oxidation of diacetonamine ; while a paper published a few months since describes a new aceton base containing sulphur. Prof. Heintz's activity was manifested up to within a few months of his death. In addition to the paper just alluded to his contributions to chemical literature during the year just closed include articles on triaceton-diamine, on the existence of acetonine, on two compounds of urea with chloride of gold, and on diethidene lactamic acid.

Prof. Heintz was the recipient in 1862 of thehonorary degree of M.D. from the University of Königsberg in recognition of his services to physiological chemistry. In 1876 he was elected an honorary member of the London Chemical Society. T. H. N.

SMOKE ABATEMENT

A MEETING was held in the Egyptian Hall at the Mansion House on Friday last, under the presidency of the Lord Mayor, to consider the best means of remedying the evils arising from the present smoky condition of the atmosphere of London. Among those present were Mr. G. J. Shaw-Lefevre, M.P. (First Commissioner of Works), Mr. W. Spottiswoode (President of the Royal Society), Dean Stanley, Sir U. Kay-Shuttleworth, Dr. Farquharson, M.P., Mr. Ernest Hart (Chairman of the joint committee of the Health and Kyrle Societies), Col. Festing, R.E., Dr. Alfred Carpenter, and Prof. Chandler Roberts.

Mr. Ernest Hart, in explaining the objects of this movement, said that some practical advance had already been made. It was not pretended that fogs could be prevented ; but since smoke added opaqueness and corrosive and other deleterious qualities to London fogs, much might be done to diminish the discomforts and evils we suffered from this cause. Having described the objects proposed to be attained by an exhibition of apparatus and smokeless fuel, he gave the results of some calculations in order to bring home to the minds of his hearers the enormous waste of money involved in the present arrangements for heating houses.

Mr. Spottiswoode stated that a committee of the Royal Society had been appointed to investigate the facts connected with the formation of fog ; but while we looked to science to tell us what was wanted to improve our atmosphere, we looked to the legislature to carry out those effectual preventive measures which all hoped would some day or other be devised. Nevertheless, without the strenuous aid and co-operation of every householder the best legislation could be turned to but little account. In conclusion he moved, "That it is the opinion of this meeting that the smoky condition of the atmosphere of London injuriously affects the health and happiness of the community, besides destroying public buildings, deteriorating perishable fabrics, and entailing in various ways unnecessary expenditure."

Sir Frederick Pollock seconded the resolution, and urged that much might be done if every one who had an old fire-grate to replace would provide one of an approved and really more economical pattern.

Mr. G. J. Shaw-Lefevre moved, "That this meeting is further of opinion that the injurious effects of fog are largely due to the quantities of smoke given forth from the chimneys of furnaces, manufactories, and steam-vessels, as well as dwelling-houses, and that the smoke in the metropolis might, without any considerable difficulty, be greatly lessened by the better enforcement of the existing law, by the introduction of amended legislation, and by the general use in all descriptions of premises, including dwelling-places, of proper smoke-preventing apparatus, improved household stoves and grates, or of smokeless fuel." As the head of the public department responsible for the public works of this great metropolis, he need hardly assure those present that he was deeply impressed with the importance of the subject under discussion. The importance of pure water was often insisted upon, but surely pure air was even more important. Yet, for years past, it must be admitted that the air of London had been getting worse, and fogs were denser and of longer duration than formerly, even invading the summer months. There could be no doubt that forty or fifty years ago London was famous for its roses ; now it was impossible to get the rose to blossom here, and it was all but impossible to get any of the conifers to grow in the darkness of the London atmosphere. He should, however, deprecate any hasty attempts to legislate. Much might be done by the extension of the existing Acts relating to the abatement of the nuisance from smoke, and he thought Government might be rightly called upon to give some additional facilities for the purpose of enforcing those Acts. It was monstrous that in these days so many factories should not be consuming their own smoke, and, since there was a great economy in the use of appliances which prevented this waste of fuel, there was no hardship in enforcing the Act. When they came to the question of the domestic consumption, he thought it would not be wise to attempt to interfere by any legislation. They must rather trust to persuasion and example and inducements. His own hope was in the introduction of some other heat-giving apparatus. Doubtless the substitution of anthracite for north-country coal would be an advantage ; but he did not see the means of persuading the enormous mass of householders to use the smokeless coal unless it could be distinctly proved to them that there would be economy in the change. He would suggest that it might be worth while for the gas companies to turn their attention to the production of gas for heating purposes. He could not help thinking that the time was not very far distant when not only our streets and public buildings, but also our private houses, would be lighted by electricity. There were non-luminous gases suitable for heating purposes, which might be made at a much less cost than the gas at present supplied for lighting. From a friend he had learnt that water-gas, which could be made at a low rate, was used in many towns in America for heating purposes. Every one could do something to help forward this good work of abating smoke, and for himself he would promise to use his efforts in the department with which he was connected to diminish the nuisance from smoke. When he mentioned that some 20,000 tons of coal were purchased annually by the department, the meeting would appreciate the extent to which the public offices added to the smoke in the atmosphere of the metropolis. He hoped the time would not be far distant when they would have restored the atmosphere of London to its early purity, the blossom to our London roses, and the bloom to the cheeks of our London children.

Dr. Alfred Carpenter urged that this was a question particularly affecting the middle class and the poor, the waste of fuel at present being deplorable. He moved "That this meeting approves the proposal of the joint Committee of the National Health and Kyrle Societies to hold an exhibition, by permission of Her Majesty's Commissioners for the Exhibition of 1851 and the other authorities, in buildings erected for the International Exhibition of 1862, of the various smokeless coals and other fuels, and of various appliances applicable to household and manufacturing purposes for the reduction of smoke, and to test the same, in order to demonstrate for public information the means practically available to secure that object. This meeting is of opinion that the investigation and testing should precede any application for amendment of the existing Smoke Acts, or for new legislation in regard to smoke from dwelling-houses."

THE INDO-CHINESE AND OCEANIC RACES—TYPES AND AFFINITIES[1]

III.

IN the accompanying series of illustrations the late King of Camboja (Fig. 14) and the Stîeng of the forest region east of the Me-Khong, between 12°–13° N. lat. (Fig. 15), may be compared, on the one hand, with the famous statue of the leprous king, Bua-Sivisi Miwong (Fig. 16), the traditional builder of the temple of Ongkor-Vâht, and on the other with the first King of Siam and his late Queen (Figs. 17 and 18). Here the resemblance of Figs. 14, 15, 16 to the European type and difference from the Mongoloid Siamese (17 and 18) is too obvious to need further comment. For these illustrations from Mouhot's "Travels in Siam, &c.," I am indebted to the courtesy of the publishers, Messrs. Murray, Albemarle Street.

The Caucasian element in Indo-China differs from the Mongoloid quite as much in speech as it does in other respects. Here the Mongol races, as already stated, all speak monosyllabic toned languages; but the Cambojans and kindred peoples all speak polysyllabic untoned languages, a fact scarcely yet recognised even by the best-informed philologists. Taking the Khmêr as the typical language of this group, it will be convenient here to establish its polysyllabic character, reserving the question of its true affinities till we come to the allied races of Malaysia and Polynesia. The so-called monosyllabic or isolating family of languages—Chinese, Tibetan, Annamese, Siamese, Laos, Khasia, Shan, Burmese, Khyeng, Karen, Talaing, Kuki, and most of the innumerable Himalayan dialects—must all be regarded as at present reduced to a state of profound phonetic decay. Whether originally they were all essentially monosyllabic, possessing, like the Aryan, roots of one syllable only, it is very difficult to say; but it seems certain that they were not originally toned. In fact there can be no reasonable doubt that the tones are a later development, worked out unconsciously to preserve distinctions between words that had assumed the same form by loss of initial or final letters. Thus in Chinese the final letters *m*, *k*, *t*, *p* have disappeared in the correct Mandarin dialect, causing roots like *kom*, *kok*, *kot*, *kop* all to assume the form of *ko*, toned four different ways according to the sense.

This principle, which, combined with the absence of inflection or root modification, constitutes the very essence of the monosyllabic system, pervades the whole family. But it is absolutely unknown in the Khmêr group, in which words, whether monosyllables or polysyllables, are always uttered without intonation, as in all other languages. Its polysyllabic character was not recognised by Francis Garnier, but it has been abundantly demonstrated by Bouillevaux and Aymonnier, and will be made evident further on. But because the Cambojans are of Caucasian, and their speech of polysyllabic, type, it does not follow that the Cambojan must be an Aryan language. As already pointed out, within the Caucasian ethnical, there are several fundamentally distinct linguistic groups, which are now past reconciliation. To attempt to affiliate Cambojan with Sanskrit must necessarily end in failure, as did Bopp's attempt to include the "Malayo-Polynesian" in the Aryan family. It must always be remembered that man is at least a quaternary, if not a tertiary animal, consequently that human speech is probably several hundred thousand years old. This period has been too short to evolve more than perhaps three or four really distinct physical types, but it has been long enough to evolve perhaps hundreds of really distinct linguistic types, many now extinct, some lingering on in contracted areas and remote corners, several, like the Sorb of Lusatia and the Pyrenean Basque, actually dying out, some few, like the Chinese, Russian, Spanish, and especially English, absorbing most of the rest, and threatening to divide the world between them.

[1] Continued from p. 224.

B.—CAUCASIAN TYPE—(*Continued*)

V. OCEANIC BRANCH: *Indonesian and Sawaiori, or Eastern Polynesian Groups.*

All the Oceanic peoples, other than the dark races of Class A, are commonly grouped together under the collective term "Malayo-Polynesian." By this name are consequently understood all the yellow, brown, or olive-brown inhabitants of Malaysia and the Indian and Pacific Oceans, that is to say, all varieties of Malays in Malacca and the Dutch East Indies, the Malagasy of Madagascar, the Philippine Islanders, the Micronesians, the natives of Formosa and the large brown Eastern Polynesians. The expression was originally proposed by William von Humboldt, merely in a linguistic sense, to designate the group of fundamentally connected languages, which really prevail amongst all these widely diffused peoples. But, like Aryan and so many other similar terms, it gradually acquired an ethnical meaning, and most ethnologists now take it for granted that there is a Malayo-Polynesian race, as there is a Malayo-Polynesian speech. But such is not the case, and as on the mainland, so in the Oceanic area, the presence of the two distinct Caucasian and Mongolian types must be recognised and carefully distinguished. It seems hopeless to do this as long as the misguiding expression Malayo-Polynesian continues to figure in scientific writings. While retaining Malay for the typical olive-brown Mongolian element in the Eastern Archipelago, I have elsewhere proposed *Indo-Pacific* for the brown Caucasian element in the Indian and Pacific Oceans, and *Sawaiori* for the large brown Polynesians, constituting the eastern and most important branch of that element.

It has already been remarked that the Caucasians are the true autochthones of Indo-China. They seem to have also preceded the Mongol migration to the Archipelago, no doubt driven thither by the continual pressure of the Mongols advancing southwards and eastwards from High Asia. In the Archipelago they occupied chiefly the large islands of Sumatra, Borneo, Gilolo, and Celêbes, here probably exterminating the aboriginal Negrito tribes. But here also they were followed by the Mongols from the mainland, with whom some amalgamated, producing the present mixed races of Western Malaysia, while others migrated eastwards to their present homes in the Eastern Pacific. Here they occupy almost exclusively all the islands east of a line running from Hawaii through Samoa to New Zealand, those groups included. West of that line they are found mostly blended with the Melanesians, as explained in Section II., but also in a pure state at a few isolated spots such as the Ellice and Phœnix Islands, Rotuma and Uvea in the Loyalty group. They are also found blended with the Malay and other elements in Micronesia.

That this large brown race reached the Pacific from the west there can be no reasonable doubt, and this view is now consequently held by Hale, Flower, Whitmee, de Quatrefages, and most recent ethnologists. F. Müller and de Quatrefages have even identified their legendary *Pulotu*, or Western Island of the Blest, with *Buro* in Malaysia, which is accordingly taken as their probable starting-point. But from whatever place they set out, they seem to have settled first in Samoa, which may therefore be taken as their second point of dispersion. "From this centre, and more particularly from the Island of Savaii, the principal of the group, their further migrations may be traced with some certainty from archipelago to archipelago through the uniform traditions of the various groups. In these traditions Savaii[1] is constantly

[1] This word *Savaii* has by some been identified with *Java*. But the primitive form seems undoubtedly to have been Savaiki, in which both *s* and *k* are organic. On the other hand Java is the Sanskrit *Yavah* for *Diavah*, the two-stalked barley, where the initial organic is *d*, dropped as in the Latin *Janus* for *Dianus* (root *duo*). Besides, although there are many Sanskrit words in the Malay dialects, there are none in the Sawaiori, the Caucasians having migrated eastwards long before the appearance of the Hindus in the Archipelago. Hence although they may have

FIG. 14.—Caucasian Type, Indo-China. King of Camboja.

FIG. 15.—Caucasian Type, Indo-China. Stieng Savage, Cochin-China.

referred to under diverse forms as the original home of the race, or otherwise persists, as shown in the subjoined list, which will also serve to illustrate the permutation of letters in all these closely-connected dialects :—

SAVAIKI.—Organic Sawaiori form of the word.

SAVAII.—The Samoan form; here still the name of the island referred to in the Sawaiori traditions.

HAVAII.—The Tahitian form; here "the universe," "the world" in the national odes; also the old capital of Raiatea Island.

AVAIKI.—The Rarotonga form; here "the land under the wind."

HAWAIKI.—The Maori form; here the land whence came the first inhabitants of New Zealand.

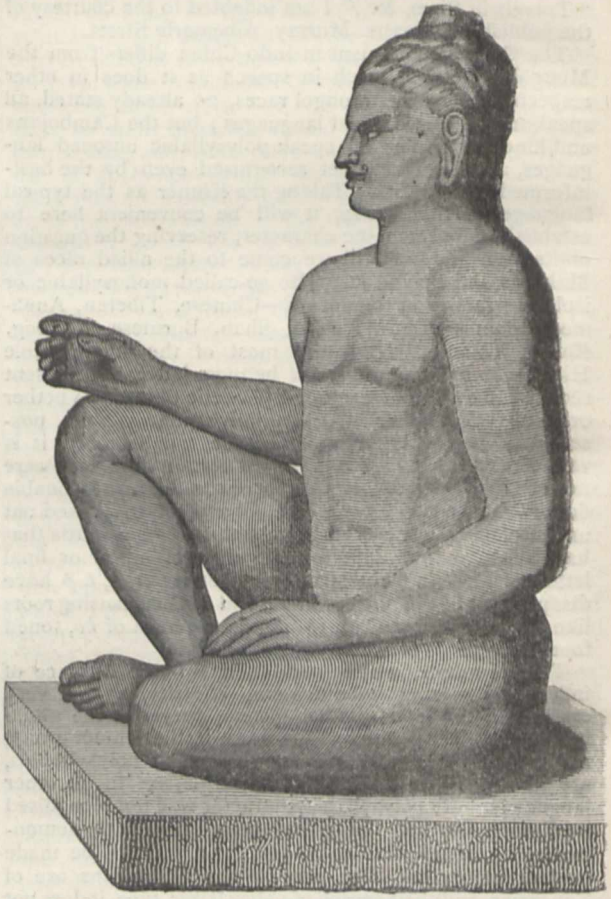

FIG. 16.—Caucasian Type, Indo-China. Statue of the Leprous King, founder of Ongkor-Vâht, Camboja.

HAVAIKI.—The Marquesas form; here "the lower regions of the dead." Over the victims in human sacrifices are uttered the words, "To fenua Havaiki" = Return to the land of thy forefathers.

HAWAII.—The Sandwich form; here still the chief island of the group.

HEAVAI.—The form in chart published by R. Forster in vol. v. of Cook's Second Voyage, and based on information furnished by Tapaia, a native of Tahiti, who had no personal knowledge of Samoa.

HEAWIJE.—The form given by Cook in his account of his first visit to New Zealand (1770).[1]"

started from Java, they could not have carried its present name with them. I note that Prof. Sayce now identifies *Janus* with the Etruscan *Ani*, accounting for the *J* by assimilation with *Janua* (*Academy*, August 21, 1880). But is not *Janua* itself a derived form from *Janus*, whence also *Januarius*?

1 "Philology and Ethnology of the Inter-Oceanic Races," by A. H. Keane, in Stanford's "Australasia," 1879.

Dates have even been assigned for these various migrations. Thus we are told that the Polynesians made their appearance in the Marquesas Islands about the beginning of the fifth century A.D., in Tahiti about 1100, in Rarotonga about 1200, in New Zealand about 1400, and so on. But all this, depending on the oral genealogies of the chiefs, and other equally unreliable data, must be regarded as pure conjecture. More probable is the statement that the race appeared in Malaysia over a thousand years before any mention occurs of Malays in that region. At the same time it is idle to attempt assigning dates to strictly prehistoric events, with the correct sequence of which we are more concerned.

The Sawaiori are one of the finest races of mankind, Caucasian in all essentials, and without a trace of Mongolian blood. Observers, from Cook to the members of the *Challenger* Expedition, are unanimous in describing them as distinguished by their fine symmetrical proportions, tall stature, handsome and regular features. Cook gives the palm to the Marquesas Islanders, who, "for fine shape and regular features, surpass all other natives." The Samoans and Tahitians are very little inferior, and even of the Tongans (Friendly Archipelago) Lord George Campbell remarks:—"There are no people in the world who strike one at first so much as these Friendly Islanders. Their clear, light copper-brown coloured skins, yellow and curly hair, good-humoured and handsome faces, their *tout ensemble*, formed a novel and splendid picture of the *genus homo*, and as far as physique and appearance goes they gave one certainly an impression of being a superior race to ours." Their average height is five feet ten inches, ranking in this respect next to the Tehuelches of Patagonia; they have smooth but not lank hair, often curly and wavy, and Mr. Staniland Wake has recently shown that, against the commonly-received opinion, the beard is naturally full, though often artificially removed. Add to all this a cheerful joyous temperament, a frank and truthful disposition and kindly nature, and you have a type as different as it is possible to imagine from the Mongolian, and consequently from the true Malay. Yet the Sawaiori and Malays are grouped together under the collective designation of "Malayo-Polynesians," as if they were merely two varieties of a common stock. All they have in common are one or two cranial features, of no particular value as racial tests, at least when taken apart, and the elements of their language, which we shall see is in this instance no racial test at all. The true affinities of the Sawaiori are with the Caucasians of Indo-China, and with that fair element in Malaysia which Dr. Hamy proposes to group as Indonesians, and whose relations to the Eastern Polynesians he has been one of the first to perceive. Noteworthy amongst these Indonesians, Pre-Malays, or Indo-Chinese Caucasians still unaffected by Mongol influences in the Archipelago are the Mentawey Islanders, who, though occupying the Pora Group some seventy miles off the west coast of Sumatra, are none the less closely related in physique, language, and customs, to the Eastern Polynesians. On this point the testimony of C. B. H. von Rosenberg is decisive. "On a closer inspection of the inhabitants the careful observer at once perceives that the Mentawey natives have but little in common with the peoples and tribes of the neighbouring islands, and thus as regards physical appearance, speech, customs, and usages, they stand almost quite apart. They bear such a decided stamp of a Polynesian tribe that one feels far more inclined to compare them with the inhabitants of the South Sea Islands."

FIGS. 17, 18.—Mongoloid Types, Indo-China. King and Queen of Siam.

From this point of view it will be instructive to compare the native of Pora, Mentawey Group (Fig. 19), with the Battas of Pak-Pak, Sumatra (Figs. 20 and 21), all from von Rosenberg's "Malay Archipelago," vol. i. pp. 56 and 192. Owing to their splendid physique and "Caucasian features" Junghuhn and Van Leent take

FIG. 19.—Caucasian Type, Malaysia. Mentawey Islander.

these Sumatran Battas as the typical unmixed or pre-Malay element in the Archipelago, whom they would accordingly group collectively as the Batta race. The form *Battak* often occurs, but this is simply the plural of Batta, so that to write *Battaks*, as many do, is a solecism. Compared with the Malays proper, the Battas are tall and muscular,

FIG. 20.—Caucasian Type, Sumatra. Native of Batta Land.

with regular features, less prominent cheek-bones, light-brown complexion, with a ruddy tinge on the cheeks, finer hair, often brown and wavy, thicker beard. When in Jilolo in 1876 M. Achille Raffray met some so-called "Alfuros" of Dodinga, who might be taken as typical specimens of this Batta or Indonesian race (*Tour du Monde*, April 12, 1879, p. 234). We therefore separate this Batta, Indonesian or Pre-Malay element in the Archipelago from the Malay element proper, affiliating the former to the Indo-Chinese and Eastern Pacific Caucasians, the latter to the Indo-Chinese Mongolians. Whether the Caucasians are found in other parts of East

FIG. 21.—Caucasian Type, Malaysia. Native of Pak-Pak, Batta Land.

Asia is a question that cannot here be discussed, but it may be remarked that even the cautious Topinard ventures to include "the Ainos of Japan, the Miau-Tz' and the Lolos of Yunnan in the European group" ("Anthropology," p. 476).

C. MONGOLIAN TYPE

VI. CONTINENTAL BRANCH: *Indo-Chinese Group.*

VII. OCEANIC BRANCH: *Malayan Groups.*

The main features of the continental branch of this division are too well known to need special comment here. What we are more immediately concerned with is its relation to the Oceanic section, and this relation will come out the more clearly if both are treated together. To avoid misconception, it may be well to observe that a portion only of the Continental branch is comprised in the Indo-Chinese group; for there are many other groups, such as the Mongolian proper, the Manchurian, the Tatar or Tûrkic, the Japanese, the Corean, the Finnic scattered over the greater part of Asia and penetrating westwards to the Baltic seaboard and Middle Danube basin. All these must be held, apart from the question of miscigenation, to belong to one primeval stock, constituting the Yellow or Mongolian division of the human family. We are all familiar with its essential characteristics: flat and broad features, prominent cheek-bones, short broad and flat nose, black almond-shaped and oblique eyes, long black and lank hair nearly cylindrical in section, little or no beard, low stature averaging about 5 feet 4 inches, dirty yellow or tawny complexion, slightly prognathous and more or less brachycephalous head.

This description corresponds substantially with the ordinary Malay type, such as we see it in Java, Bali, Madura, many parts of Sumatra, round the coast of Borneo, and in the peninsula of Malacca. The true aborigines of this region, as shown in a previous section, were the Negritos; consequently the Malays, like the

pre-Malays or Caucasian Indonesians, are here intruders. Intruders from where? Obviously from where the type exists, the neighbouring Indo-Chinese peninsula. What then becomes of the Malay as a primary division of mankind? As such it can no longer be recognised in anthropology, and must sink to the position of a mere variety of the Mongol type. The so-called true Malay or typical Malay is essentially a Mongolian, and the likeness between the two has not failed to strike all careful observers. "The Malayan race," says Wallace, "as a whole undoubtedly very closely resembles the East Asian populations from Siam to Manchuria. I was much struck with this, when in the Island of Bali I saw Chinese traders, who had adopted the costume of that country, and who could then hardly be distinguished from Malays; and on the other hand I have seen natives of Java who, as far as physiognomy was concerned, would pass very well for Chinese." Hence De Quatrefages rightly rejects the claim of the Malays to be regarded as a fundamental type. "All polygenists," he remarks, "have regarded the Malays as one of their *human species*; many monogenists have considered them as one of the principal races. I showed long ago that in reality they are only a mixed race in which white, black, and yellow elements are associated."

The last clause of this sentence gives the true solution of the problem. The inhabitants of Malaysia consist not of one, nor even of three distinct races, but of three races variously intermingled, the yellow or Mongolian, and the white or Caucasian chiefly in the west, these two and the black or Papûan chiefly in the east. As the fusion of yellow, white, and black produces the so-called "Alfuros" in the east, so the fusion of yellow and white produces the so-called Malays in the west. The more the yellow prevails the nearer do the Malays approach the Mongol type; the more the white prevails the nearer do they approach the Caucasian type, until in some places they seem to be no longer distinguishable from the Mongols, in others from the Caucasians. The Javanese are taken for Chinese by Wallace, just as the Mentawey Islanders are taken for Sawaiori or Eastern Polynesians by von Rosenberg. Under these circumstances it is not surprising that those who seek for unity in the Archipelago should meet with nothing but confusion. Prof. Flower comments on the divergent characteristics presented by the Malayan crania, remarking that "there is certainly no very great conformity in the characters of the skulls in our collections which are said to belong to Malays." This must always be the case until we come to an understanding as to the meaning of the term Malay, which after all is far more a national and linguistic than a racial expression. Proceeding on the groundless assumption of a common Malay type in Oceanica, Welcker arrived at the subjoined astonishing results from cranial measurements in Micronesia and Malaysia alone:—

Length of Skull 100

	Index of breadth.	Index of height.	Difference.
Caroline Islanders ...	68	74	+ 6
"Alfuros"	74	79	+ 5
Dyaks of Borneo ...	75	77	+ 2
Balinese	76	77	+ 1
Amboynese	77	77	+ 0·4
Sumatran	77	78	+ 1
Macassar	78	78	− 0·5
Javanese	79	80	+ 0·4
Buginese	79	80	+ 0·4
Menadorese	80	81	+ 1
Madurese	82	82	− 0·1

Yet even here Sumatran is taken as a unit, although it is not hazarding too much to say that a comparison of Atyeh, Batta, Palambang, Janebi, Siak, Menangkabu, Korinchi, Rejang, Lampung, and other crania from that island alone would probably yield almost as many discrepancies as are revealed in this table. There is in fact less uniformity of type in Malaysia alone, with a population of some 25,000,000, than in the whole of China and Mongolia with a probable population of 400,000,000.

A. H. KEANE

(*To be continued.*)

A CHAPTER IN THE HISTORY OF THE CONIFERÆ

II.

GINKGO (Linnæus)

THE perhaps better known name of this genus is Salisburia (Smith), but the Linnæan name, adapted from the Chinese, has unfortunately priority. The genus contains only one existing species, the gigantic *Ginkgo biloba* of Northern China and Japan. It is classified with the Taxeæ, is diœcious, and the flabelliform leaves are deciduous, leathery, very variably lobed, and of all sizes up to an extreme of five inches across. The fruit, about an inch in diameter, is drupaceous, on a slender footstalk, composed externally of a fleshy layer, and internally of a hard light-coloured shell, and is somewhat unsymmetrical, owing to the abortion of one of the seeds. The foliage is like that of the maidenhair fern, but the petiole is stout, often three inches long, and distinctly articulated at the base. An important characteristic in recognising the fossil leaf, besides the petiole, is that however irregularly they may be lobed, they are almost invariably primarily bilobed.

Though so restricted a genus now, its ancestry is perhaps more venerable than that of any other forest tree. The Carboniferous fruits Trigonocarpus and Noeggerathia are believed by both Hooker and Saporta to have belonged to some ancestral form, and even the foliage of the latter, Psygmophyllum of Schimper, approaches nearly to that of Ginkgo. Baieria, beyond doubt a close ally, appears in the Permian, and Ginkgo in all probability in the bilobate Jeanpaulia of the Rhœtic of Bayreuth, but the group did not reach its maximum until the Jurassics. A few species have been described in other works, but Heer's Jurassic flora of Eastern Siberia ("Flora foss. Arctica," vol. iv.) contains by far the most important contribution to their past history. Five genera are placed in the groups: *Phœnicopsis*, *Ginkgo*, *Baieria*, *Trichopitys*, and *Czekanowskia*, but there is no special character uniting the latter to Ginkgo, although it is no doubt coniferous. The remains are clusters of occasionally forked acicular leaves, sheathing at the base in imbricated scales. The leaves widen in most specimens here and there into bead-like expansions, inferred to have been caused by some extinct type of parasitic fungus. It is thought by Heer that a detached stem bearing shortly petiolated double seeds or nuts may be their fruit. Phœnicopsis is a cluster of separate leaves, also sheathing in scales at the base, but forming a fine palm-like foliage, thought by Heer to unite Cordaites and Baieria, yet without any direct affinity with Ginkgo.

The most aberrant of the genera obviously belonging to the group is Trichopitys of Saporta. In this the leaves were smaller, with fewer veins, and the parenchyma reduced to a narrow expansion margining each vein. Although so extreme a modification of the normal type, *T. setacea*[1] possesses the characteristic bilobation and petiole. Its affinity is best traced through *G. concinna*, which is similar, but with the segments of the leaves expanded to receive two to three veins each.

G. sibirica and *G. lepida* are separated on trivial grounds not supported by the illustrations, and when united furnish the chief and most abundant leaves in the deposit. These are nearly as large as in the existing species, but more digitate, and with about five veins to

[1] *T. pusilla* probably belongs to some other division of the vegetable kingdom.

each segment. They have the venation, bilobation, and petiole of Ginkgo, yet approaching in their larger leaves to Baieria. Other similar species (?) diminishing in size are *G. schmidtiana*, with about six segments, *G. flabellata*, with fourteen or fifteen segments, and *G. pusilla*, with a less number, and barely an inch across the base. These three might probably be united into a single species. The remaining form from Siberia, *G. huttoni*, is less divided, having but four rounded segments, and is in that respect a nearer approach to the existing one.

The nearest, however, is *G. digitata* from the Jurassic of Spitzbergen, which, but for smaller size and thicker petiole, might be placed in the existing species. Leaves from Scarborough, said to be of the same species, are larger. *G. integriuscula* is evidently the smaller and less lobate leaf of the same species, and the author has besides taken the unnecessary care to establish five duly named and lettered varieties, thus clearly showing that he had formed no adequate conception of the extent to which the leaves of the existing tree may vary, even on the same branch. His species should be reduced, the excessive subdivision being a disadvantage and rendering the work unwieldy. The author also changes the classification of the Coniferæ between the second and third volumes, and the name for this genus between the third and fourth volumes, without explanation or notice, which, in a work addressed especially to geologists, is an inconvenience.

The third genus, Baieria, possesses a larger and more palm-like leaf, averaging nearly five inches in radius, primarily bilobed, each lobe forking either once or twice, the ultimate segments being of uniform width and possessing four parallel veins each. The leaf tapers to the petiole, which is not preserved in the engraved specimens. The bilobation and venation connect it sufficiently with Ginkgo, and the persistence of these characters throughout the whole group, which would hardly have been suspected to have a morphologic value, is peculiarly remarkable.

There is a marked diminution in the group in the Cretaceous. Baieria from the Komeschichten is limited to vestiges of stunted form placed among the ferns, while Ginkgo appears in a starved species with small leaves and short thick petiole, described as *Adiantum formosum*, and by fragments from the Upper Cretaceous Ataneschichten, inappropriately named *G. primordialis*.

In the Arctic Eocenes (Miocenes of Heer) Ginkgo has only, and that very sparingly, been met with in Greenland. This variety so resembled *G. adiantoides* of the Italian Miocenes, that Heer almost directly abandoned his specific name *primordialis*, and became doubtful even whether both should not be united with the existing species.

The small fragments figured in the Miocene Baltic flora are inconclusive, and we only again meet with it in the Miocenes as far south as Italy, the South of France, and the Mississippi.[1] It has been said to occur in English Eocenes by Heer, who wrote upon the tracing of an Adiantum from Bournemouth, "this is a Ginkgo," and by Ettingshausen, who considers four seeds from Sheppey to belong to it, although less than half the size of those of the present Ginkgo, and rather materially differing. Its absence otherwise in British and in French Eocenes, and in the Swiss and Austrian Tertiaries, is ascertained, for the occurrence of so distinctly-marked and easily-preserved a leaf could not well be overlooked.

The very strongly-marked and exceptional characters of Ginkgo, shared by the allied extinct genera, the remoteness of its origin in the Carboniferous, its extensive development in the Mesozoic, and persistence through so many ages, seems to render it desirable to separate them from the Taxeæ into a distinct tribe. Already dying out in the Cretaceous and lingering through the Tertiaries in a single species, its existence now is a mere survival.

[1] Since writing the above, Saporta informs me that the supposed Mississippi species is really a Lygodium.

Its home has been from time to time within the Arctic circle, yet it is scarcely proved, as Saporta says, that it actually originated there. The leaf of *G. digitata* from the Scarborough oolite, figured by Schimper, is far larger than any figured from Spitzbergen, and neither the foliage nor the fruit of the northern fossil Ginkgo, it appears, ever at any time approached those of the existing tree in its native habitats. It is now indigenous to the northern provinces of China, and must therefore be capable of withstanding a rigorous climate; yet the conditions in Western Europe do not appear to favour the ripening of its seed in higher latitudes than the South of France.

Its distribution during the Tertiaries is instructive, and Saporta's explanation, that it existed in the north during the warm Eocene and pre-Eocene times, and descended thence across Europe as the temperature decreased, on the approach of the Miocene time, is the only one that explains the facts. To suppose with Heer that the same species lived contemporaneously and at the same level in Italy and in Disco is absurd, and would presuppose a uniformity of climate such as no natural causes could have produced at so recent a geological period.

J. STARKIE GARDNER

NOTES

THE Roman Academy of Sciences has awarded half of the King Humbert Prize, now awarded for the first time, to the German astronomer, Dr. Wilhelm Tempel, director of the Acetri Observatory at Florence, for his observations on nebulæ.

DEATH is levying heavy contributions from the students of entomology in France, more especially as regards the oldest and best known. We very recently had occasion to notice the decease of Etienne Mulsant, at a ripe age. Now, we regret to have to announce the death of Achille Guenée of Châteaudun, whose name is probably more known in England than is that of any other French entomologist. He died on the 30th ult. (his colleague and fellow-worker, Dr. Boisduval, died on December 30, 1879), in his seventy-second year. Guenée was a lepidopterist. His publications are very numerous. The most important of all are the six volumes of the series termed the "Suites à Buffon" on some of the principal families of the *Lepidoptera* of the world, which appeared from 1852 to 1857. These volumes formed a basis for future students of *Lepidoptera*, and largely influenced those of them amongst our own countrymen. The town of Châteaudun occupies a not unimportant position in the history of the Franco-Prussian war. Guenée's house was occupied by the Prussian troops. He himself took refuge in Geneva, and, true to his predilections, studied the *Lepidoptera* in the collection of the museum of that city; the results of his investigations were published. We believe that when circumstances permitted his return, his own collections were found to have suffered very little damage at the hands of his unbidden guests. He was an officer of the French Academy. Our Entomological Society of London elected him one of its honorary members many years ago; and his friends amongst Englishmen were not few.

JOHN DUNCAN, a poor Aberdeenshire weaver, has presented to the University of Aberdeen his herbarium of nearly 1200 British plants, gathered by him all over the country from Northumberland to Banff, while acting as a harvest labourer. The story of Duncan was told in *Good Words* for 1878, by Mr. William Jolly, and now it would seem that the poor and intelligent weaver is so reduced in circumstances as to be compelled to accept parochial relief. Surely the University of Aberdeen ought to do something for him; and possibly some of our readers may care to send a trifle to John Duncan, Droughsburn, by Alford, Aberdeenshire.

LEIPZIG is at last to have a zoological garden. A number of citizens intend to form a company for the purpose of establishing a zoological garden on an area of twenty acres, with conservatories, &c. The civic authorities of Leipzig have given their consent, and pointed out a suitable place in the immediate environs of the city.

THE base of the Mont Cenis tunnel at the French entrance shows such ominous signs of sinking that the Paris-Lyons Mediterranean Railway Company intend to have another entrance to the tunnel bored, which is to be situated at about 1 kilometre's distance from the present entrance, and is to reach the old tunnel at a spot about 600 metres from its mouth. The work has already been commenced.

VISITORS to the Brighton Aquarium will regret to hear of the death of the fine male sea-lion (*Otaria stelleri?*), so long an inmate of the Institution. Mr. A. Crane sends us some details about the animal. Poor "Jack's" very sudden death is attributed to disease of the heart. The left lobe of that organ was found ruptured and in a state of complete collapse. His female companion is still in good health. The first offspring of the pair, a male cub, was born in the spring of 1877; the second, a dead female, in the following year. Jack was probably about twelve years of age at his death. His length was 8 feet 5 inches, maximum girth 5 feet 3 inches; fore-feet 4 feet 2 inches, and hind flippers 17 inches; greatest circumference of the head 2 feet 10 inches, frontal 2 feet 2 inches, round the jaws, under the eyes, 17 inches; weight of skin 1 cwt., of lungs 22 lbs. As the skeleton will be preserved in the Institution zoologists will be able to finally determine by means of the skull the exact species to which this male belonged. The cub born of this pair is now four years old, a fine animal 6 feet long and much larger than his somewhat diminutive and flat-headed mother, to whom at present he bears most resemblance, the extraordinary prominence of the frontal bones of the skull characterising his male parent being as yet undeveloped. The tanks, Mr. Crane states, are in excellent condition, and the growth of sponges, tunicates, and development of invertebrate life generally is very remarkable. In fact to a qualified histologist and embryological student they would furnish ample material for a vacation, and doubtless yield interesting results. Facilities for study, we are informed, would be willingly accorded by the Management.

PROF. E. MORREN'S *Correspondance botanique* grows in size and in completeness. We have now before us the eighth issue (October, 1880) of this most useful botanical directory. In Europe and the United States the list of botanists, official and others, is now very full and complete; and scarcely any quarter of the globe can be named which is not represented by one or two names. Every working botanist should have it on his library table.

AT a quarter to 5 p.m. on January 5 a somewhat violent shock of earthquake was felt at Agram. It lasted about three seconds. The ground rose in wave-like curves as the shock passed over. On the previous night two slight shocks were experienced.

THE *Times* Bucharest correspondent, under date January 4, describes a curious result following the recent earthquake which passed under that city. The soil of Bucharest is a rich, black, porous vegetable mould, very springy under pressure, and carriages passing in a street cause a strong vibration in the adjacent houses. The Grand Hôtel Boulevard, however, was an exception to this general rule, and in the correspondent's room, facing the principal street, on which there is a heavy traffic, he never could feel any sensible effect from passing vehicles. During the recent earthquake the windows and crockery in less massively constructed buildings rattled very sensibly, whereas there was no audible sound produced in the hotel mentioned. Since the earthquake shock, however, this state of things has changed entirely, and every vehicle passing the hotel causes vibration in the whole building. The singular part of this change consists in the fact that the effect produced by the vehicle is precisely the same as that accompanying the earthquake. It is not a jar as previously produced in other buildings, but a sawing motion similar to that described in the correspondent's telegram relating to the late shock of earthquake. This movement is so great as to cause pictures to sway backwards and forwards on the walls, and it is equally perceptible in the rear corner rooms farthest from the street. The hotel is of brick, covered outside with mastic, which would show at once any crack in the walls. He has carefully examined the exterior of the building and there is not a crack in it. Hence, he thinks, this change in the solidity of the structure appears to be due to some effect produced in the earth underneath the building by the shock of earthquake.

THE *Daily News* Rangoon correspondent, writing on December 10, states that they had another shock of an earthquake in Burmah three days before the same day on which Agram was revisited. In Rangoon it was not severe, but the tremulous motion lasted for fully a minute and a half, and was sufficiently strong to set pictures swinging and rattling against the walls. Like those which preceded it, the shock travelled from south to north, and was felt more violently elsewhere, though in no case so intensely as to cause serious damage.

ON the 6th inst., at 4.30 a.m. Berlin time, a pretty strong shock of earthquake was felt at Rousdorf.

DR. KRISHABER of 41, rue de la Bienfaisance, Paris, writes to ask if any of our readers can give him information as to the causes of death in monkeys in a wild state.

THE appearance of the phylloxera in the Crimea has been the subject of a communication, by M. Porchinsky, to the St. Petersburg Entomological Society. It has appeared probably in consequence of vines having been imported from France, and has extended hitherto very slowly in small concentric circles. As the vineyards are situated on the southern coast of the Crimea in the shape of a narrow strip at the foot of the mountains, M. Porchinsky thinks that the devastating insect will not cause much destruction. But if it appeared on the Caucasus, especially among the numberless wild vineyards of that country, it might completely destroy the whole of the vines in the valleys of the Rion and Kura rivers.

MR. F. W. PUTNAM has made a communication to the Essex (U.S.) Institute of peculiar interest on "The Former Indians of Southern California, as bearing on the origin of the Red Man in America." He called attention to the facts relating to the antiquity of man on the Pacific coast, and to the importance of the discovery in California of human remains and of the works of man in the gravel, under beds of volcanic material, where they were associated with the remains of extinct animals, and to the necessity of looking to this early race for much that it seems otherwise impossible to account. He thought that what is called the "Eskimo element," in the physical characters and arts of the southern Californians, was very likely due to the impress from a primitive American stock, which is probably to be found now in its purest continuation in the Innuit. In this connection he dwelt upon the probability of more than one type of man. In following out this argument he called attention to the distinctive characters in different tribes of Indians on the Pacific coast, and stated his belief that they had resulted from an admixture of the descendants of different stocks. The Californians of 300 years ago, he thought, were the result of development by contact of tribe with tribe through an immense period of time, and that the primitive race of America, which

was as likely autochthonous as of Asiatic origin, had stamped its impress on the people of California. The early men of America he believed were dolichocephali, and the short-headed people he thought were made up of a succession of intrusive tribes in a higher stage of development, which in time overran the greater part of both North and South America, conquering and absorbing the long-headed people, or driving them to the least desirable parts of the continent. He thought that the evidence was conclusive that California had been the meeting ground of several distinct branches of the widely-spread Mongoloid stock; for in no other way could he account for the remarkable commingling of customs, arts and languages, and the formation of the large number of tribes that existed in both Upper and Lower California when first known to the Spaniards. Mr. Putnam then gave a review of the arts of the Californians and the physical characters and customs of the people, showing that, notwithstanding the absence of pottery, the tribes, when first known, had passed through the several stages of savagery and had reached the lower status of barbarism of the "ethnical periods" given by Morgan.

PROF. SCHÄFER'S course of eleven lectures on the Blood at the Royal Institution will begin on the 25th instant instead of the 18th. Mr. Francis Hueffer's course of four lectures on the Troubadours will begin on the 27th instant instead of the 20th; and Prof. Sidney Colvin's course of four lectures on the Amazons will begin on the 29th instant instead of the 22nd.

PART 2 of vol. vii. of the "Natural History Transactions of Northumberland, Durham, and Newcastle-on-Tyne" has just been issued (Williams and Norgate). The part contains an interesting memoir of the late Mr. W. C. Hewitson, F.L.S., by Dr. Embleton, accompanied by a good photograph. There is a long paper by Mr. Hugh Miller on Tynedale Escarpments, their pre-glacial, glacial, and post-glacial features.

HERR E. REYER has published a little pamphlet containing some interesting notes on the history of tin.

AT the meeting of the Eastbourne Natural History Society of December 17, 1886, Mr. Charles Foran read "Notes on some of the Beetles of the Cuckmere District."

THE Municipal Council of Paris has given authority to the Lontin Company to light the Place du Carrousel with electricity. A contract has been signed by the Lyons and Mediterranean Company for illuminating, by the Lontin light, all the principal railway stations on their system. Experiments have been tried at Marseilles and have been carried out successfully.

FROM January 1 *L'Electricité* and *La Lumière Electrique*, two French electrical papers, will appear every week instead of every fortnight.

THE German Society of Eastern Asia, having its headquarters at Yokohama, has sent us the last four parts of its *Mittheilungen*. This Society is evidently doing a very useful work in collecting information on a great variety of subjects connected especially with Japan. The parts sent us contain papers on such subjects as Japanese proverbs, diseases, songs, population statistics, mining, cremation, the "Go" game, coins, and the chalk formation of Yedo. Asher and Co. of Berlin are the European agents of the Society.

WE find in the *Journal de Genève* the following figures as to the very warm winter which is experienced during this year on the shores of Lake Leman, as compared with the unusually cold winter of the year passed. In December, 1879, the maximum daily temperature at Geneva was only five times above zero, and the average was +6°·4 Cels., whilst the average of the maximum temperatures of the remaining twenty-six days was −4°·5 Cels. As to the minima they were only twice above zero, and their average was +2°·9, whilst the average of the remaining twenty-nine minima was −9°·7. In December, 1880, the thermometer was only six times below the melting-point, and the average of the cold minima was −0°·7, whilst the average of the minima for the other twenty-five days was +3°·8. As to the maxima they fell below zero, and their average is as high as +9°·1. The greatest cold experienced during December, 1879, was −15° Cels., and only −1°·5 in 1880; the warmest temperature observed during December, 1879, was +8°·9, and +13° Cels. in 1880.

A TEA plantation was established last year by Count d'Amigo upon his estates, situated near Messina. The tea plant is said to thrive perfectly well there, and its leaves are said to be in no-wise inferior to those of the Chinese plant. In order to dry them in a rational manner and to prepare them for export as well as for home consumption, a Chinese expert is to become the manager of the Messina plantations.

THE Wissenschaftliche Centralverein at Berlin held its annual general meeting on December 13, 1880. The secretary, Dr Max Hirsch, in his yearly report stated that the principal efforts of the Society had been directed towards furthering the progress of the Humboldt Academy, which was founded by the Society some two years ago, and which since that time shows a total of ninety-two courses of lectures, which were delivered before 3366 students and a still larger number of "hospitanten," *i.e.* casual students. Apart from these lecture-courses the Society has for this winter arranged for a number of single lectures by eminent men of science. The establishment of a large reading-room is also planned.

A YOUNG Men's Society for Home Study has been started in the United States. The aim of the Society is to guide and encourage young men desirous of systematic study and reading at home by opening to them, by means of correspondence, systematic courses in various subjects. Courses of reading and plans of work are arranged, from which men may select one or more, according to their taste and leisure, and aid is given them, from time to time, through directions and advice. The courses offered by the Society at present (more may be added as the demand for them becomes known) are: Course 1. American and English History. Course 2. English Literature. Course 3. German Literature. Course 4. Natural Science: Sec. 1, Botany; Sec. 2, Zoology; Sec. 3, Geology. Course 5. Mathematics. Mr. Samuel H. Scudder is head of the Natural Science Department.

THE simplest post-office in the world is in Magellan Straits, and has been established there for some years past. It consists of a small cask, which is chained to the rock of the extreme cape in the straits, opposite Tierra del Fuego. Each passing ship sends a boat to open the cask and to take letters out and place others into it. The post-office is self-acting therefore; it is under the protection of the navies of all nations, and up to the present there is not one case to report in which any abuse of the privileges it affords has taken place.

OUR ASTRONOMICAL COLUMN

WINNECKE'S COMET.—Reference has been already made in this column to the very unfavourable circumstances attending the actual return to perihelion of the short-period comet of Winnecke, and so far there is no intimation of its having been detected even with telescopes of the greatest optical capacity. Indeed, as will be seen from Prof. Oppölzer's communication in the *Astron. Nach.* No. 2326, though he gave an accurately-computed ephemeris extending to January 24, he considered the chance of perceiving the comet a very remote one. The perihelion passage took place on December 4, and the intensity of light is now very small, not greater than half that at the date of the last observation in 1858. The comet sets less than 1h. 45m.

after the sun. The later positions in Prof. Oppölzer's ephemeris are as follows:—

	12h. Berlin M.T. R.A. h. m. s.	N.P.D. ° ′	Log. distance from Earth.
January 16 ...	21 29 12 ...	109 41·4 ...	0·2836
18 ...	21 38 18 ...	109 9·7 ...	0·2875
20 ...	21 47 12 ...	108 36·9 ...	0·2916
22 ...	21 55 54 ...	108 3·2 ...	0·2959
24 ...	22 4 23 ...	107 28·6 ...	0·3002

SWIFT'S COMET.—Mr. Common, with his reflector of three feet aperture at Ealing, has observed this comet for position as late as January 5, when it was not yet considered the *extremum visible* in the instrument. Accurate observations were made by Mr. Lewis Boss at the Dudley Observatory, Albany, U.S., on October 11, the night after discovery, so that there will be a good extent of observation upon which to determine the orbit at this appearance.

MINIMA OF ALGOL.—The following epochs of geocentric minima of Algol are deduced from Prof. Schönfeld's elements. That very sensible perturbations have taken place during the last few years is shown by a comparison of these elements with the observations of Prof. Julius Schmidt of Athens; thus the mean errors since 1875 are, for 1875·76 − 4·8m.; 1876·76 + 19·4m.; 1877·73 + 40·8m.; 1878·78 + 21·3m. The star is well deserving of attention during the present year.

	G.M.T. h. m.		G.M.T. h. m.
January 21	18 20	February 13	16 54
24	15 9	16	13 43
27	11 58	19	10 32
30	8 48	22	7 22
February 2	5 37		

CERASKI'S VARIABLE IN CEPHEUS.—A series of minima of this star visible in Europe commences about January 13, continuing until May. The period may be taken = 2·492913d. or 2d. 11h. 49·795m., and if we reckon from the second minimum completely observed by Prof. Schmidt on October 18, 1880, we shall find a minimum on January 18 at 17h. 41m. G. M. T., and successive visible epochs may be inferred by adding 4d. 23h. 39·59m.

ELONGATIONS OF MIMAS.—According to the elements previously adopted in this column for indicating approximately the times of greatest elongations of this very difficult object, the satellite would be at the western extremity of its apparent orbit at the following Greenwich times:—

	h. m.		h. m.
January 19 ...	11 5	January 22 ...	6 56
20 ...	9 42	23 ...	5 33
21 ...	8 19		

The elements upon which Prof. Newcomb's manuscript tables adopted in the *American Ephemeris* for 1882 and 1883 are founded appear to give the times of the elongations later by some forty minutes.

THE ACADEMY OF SCIENCES, PARIS.—The recent election of Dr. Warren De La Rue as Correspondent of the Academy of Sciences of the Institute of France, Section of Astronomy, in place of the late Sir Thomas Maclear, nearly completes the usual number of correspondents in this section, upon which several vacancies had existed for some time. The roll is now as follows, taking the names in alphabetical order:—Adams (Cambridge), Cayley (Cambridge), De La Rue (London), Gyldén (Stockholm), Hall (Washington), Hind (London), Huggins (London), Lockyer (London), Newcomb (Washington), Oppölzer (Vienna), Plantamour (Geneva), Roche (Montpellier), Schiaparelli (Milan), Stephan (Marseilles), and Struve (Pulkova). The Astronomer-Royal is one of the eight Foreign Associates of the Academy.

GEOGRAPHICAL NOTES

WE are glad to learn that the rumour of the murder of Herr Hildebrandt in Madagascar is unfounded.

THE first number of the memoirs (*Zapiski*) of the West Siberian Branch of the Russian Geographical Society contains valuable papers by M. Kostroff on witches in the Government Tomsk; by M. Grigorovsky, on the peasantry in the Narym district; by M. Pyevtzoff, on his journey through Djoungaria, with a map; and by M. Balkashin, on trade *viâ* the Ob River with Europe during the years 1877 and 1878.

AT one of its recent meetings the Russian Geographical Society discussed the proposal of Mr. Fleming, transmitted to the Society by the Governor-General of Canada, as to the adoption of a universal time and of a universal first meridian. As to the suggestion to have a cosmopolitan noon at the same moment over the surface of our globe, the Society thinks that it would meet with a mass of difficulties as to its application in daily life; but the advantages which a universal time would afford being very great, the Society expresses the wish that the whole question be earnestly discussed and studied by learned societies. As to the first meridian, the Society, which already discussed the question in 1870, maintains its former resolution, namely, that the meridian of Greenwich, or at least that of Behring Strait, 180° distant from that of Greenwich, should be accepted by the whole civilised world as a first meridian.

WE have received the annual reports for 1879 of the Siberian, Orenburg, and Caucasian branches of the Russian Geographical Society, which has had the happy idea to publish all the reports together in one volume, thus rendering accessible for the general reader who knows Russian this most valuable geographical information, formerly disseminated in local publications. The oldest of these branches, the East Siberian, has endured heavy losses during the great fire at Irkoutsk. Its rich zoological, botanical, geological, and ethnographical collections were all destroyed by fire: the beautiful head of a *Rhinoceros tichorhinus*, just received from Verkhoyansk, the rare collection of samples of gold from all the gold-mines of Eastern Siberia, palæontological collections not yet described, and so on, as well as the 10,230 volumes of its rich library, and collections of old records, were all destroyed by fire. Several scientific bodies, Russian and foreign, have already sent their publications and duplicates from their libraries, so that the museum and library already are in way of reconstitution.

THE third volume of the "Rajputana Gazetteer" has just been issued from the Government press at Simla. The various sections into which it is divided are contributed by Capt. C. E. Yate, Major C. A. Baylay, and Major P. W. Powlett, and treat of general topography, history, population, trade, towns, &c. Mr. J. F. Baness, the chief draughtsman in the geographical and drawing branch of the Survey of India, has in the press at Calcutta a work entitled "Index Geographicus Indicus." It will be published in one volume, with eight coloured maps, and will comprise a list, alphabetically arranged, of the principal places in our Indian Empire, accompanied by much statistical, political, and descriptive information.

A SERIES of papers is commenced in last week's issue of *Les Missions Catholiques*, on the manners, customs, and religion of the races of the Caucasus.

The new number of the *Bulletin* of the Commercial Geographical Society of Bordeaux contains a useful paper on Japan, by M. E. Labrone.

THE Palestine Exploration Society have decided to undertake the exploration of Palestine east of the Jordan.

OBSERVATIONS ON ANTS, BEES, AND WASPS[1]

Power of Communication by something approaching to Language.

IN my previous papers many experiments have been recorded, in which I have endeavoured to throw some light on the power of communication possessed by ants. It is unquestionable that if an ant or a bee discovers a store of food her comrades soon flock to the treasures, although, as I have shown, this is by no means always the case. But it may be argued that this fact taken alone does not prove any power of communication at all. An ant observing a friend bringing food home might infer, without being told, that by accompanying the friend on the return journey she might also participate in the good things. I have endeavoured to meet this argument in my third paper (*Linn. Journ.* vol. xii. p. 466) by showing that there was a marked

[1] By Sir John Lubbock, Bart., M.P., F.R.S., F.L.S., D.C.L., LL.D., Vice-Chancellor of the University of London. Read at the Linnean Society, June 17. Abstract.

difference in the result, if on experimenting with two ants one had access to a large treasure, the other only to a small one.

It also occurred to me that some light would be thrown on the question by compelling the ant who found the treasure to return empty handed. If she took nothing home and yet others returned with her, this must be by some communication having passed. It would be a case in which precept was better than example.

I selected therefore a specimen of *Atta testaceo-pilosa*, belonging to a nest which I had brought back with me from Algeria. She was out hunting about six feet from home, and I placed before her a large dead bluebottle fly, which she at once began to drag to the nest. I then pinned the fly to a piece of cork, in a small box, so that no ant could see the fly until she had climbed up the side of the box. The ant struggled, of course in vain, to move the fly. She pulled first in one direction and then in another, but, finding her efforts fruitless, she at length started off back to the nest empty-handed. At this time there were no ants coming out of the nest. Probably there were some few others out hunting, but for at least a quarter of an hour no ant had left the nest. My ant entered the nest but did not remain there; in less than a minute she emerged accompanied by seven friends. I never saw so many come out of that nest together before. In her excitement the first ant soon distanced her companions, who took the matter with much *sang froid*, and had all the appearance of having come out reluctantly, or as if they had been asleep and were only half awake. The first ant ran on ahead, going straight to the fly. The others followed slowly and with many meanderings; so slowly, indeed, that for twenty minutes the first ant was alone at the fly, trying in every way to move it. Finding this still impossible, she again returned to the nest, not chancing to meet any of her friends by the way. Again she emerged in less than a minute with eight friends, and hurried on to the fly. They were even less energetic than the first party; and when they found they had lost sight of their guide they one and all returned to the nest. In the meantime several of the first detachment had found the fly, and one of them succeeded in detaching a leg, with which she returned in triumph to the nest, coming out again directly with four or five companions. These latter, with one exception, soon gave up the chase and returned to the nest. I do not think so much of this last case, because as the ant carried in a substantial piece of booty in the shape of the fly's leg, it is not surprising that her friends should some of them accompany her on her return; but surely the other two cases indicate a distinct power of communication.

Lest however it should be supposed that the result was accidental, I determined to try it again. Accordingly on the following day I put another large dead fly before an ant belonging to the same nest, pinning it to a piece of cork as before. After trying in vain for ten minutes to move the fly, my ant started off home. At that time I could only see two other ants of that species outside the nest. Yet in a few seconds, considerably less than a minute, she emerged with no less than twelve friends. As in the previous case, she ran on ahead, and they followed very slowly and by no means directly, taking in fact nearly half an hour to reach the fly. The first ant, after vainly labouring for about a quarter of an hour to move the fly, started off again to the nest. Meeting one of her friends on the way she talked with her a little, then continued towards the nest, but after going about a foot, changed her mind, and returned with her friend to the fly. After some minutes, during which two or three other ants came up, one of them detached a leg, which she carried off to the nest, coming out again almost immediately with six friends, one of whom, curiously enough, seemed to lead the way, tracing it, I presume, by scent. I then removed the pin, and they carried off the fly in triumph.

These and other experiments certainly seem to indicate the possession by ants of something approaching to language. It is impossible to doubt that the friends were brought out by the first ant; and as she returned empty-handed to the nest, the others cannot have been induced to follow her merely by observing her proceedings. I conclude, therefore, that they possess the power of requesting their friends to come and help them.

Recognition of Relations.—In my last paper (*Linn. Journ.* vol. xiv. p. 611) I recorded some experiments made with pupæ, in order if possible to determine how ants recognised their nest companions. The general result was that pupæ tended by strangers of the same species, and then after they had arrived at maturity put into the nest from which these strangers had been taken, were invariably treated as interlopers and attacked. On the other hand, if they were tended by ants from their own nest, and then after arriving at maturity put back in their own nest, they were invariably recognised as friends; and lastly, if as pupæ they were tended by strangers, but then after arriving at maturity put back in their own nest, they were generally received as friends. In all these experiments, however, the ants were taken from the nest as pupæ, and though I did not think the fact that they had passed their larval existence in the nest could affect the problem, still it might do so. I determined therefore to separate a nest before the young were born, or even the eggs laid, and then ascertain the result. Accordingly I took one of my nests, which I began watching on September 13, 1878, and which contained two queens, and on February 8, 1879, divided it into halves, which I will call A and B, so that there were approximately the same number of ants with a queen in each division. At this season, of course, the nest contained neither young nor even eggs. During April both queens began to lay eggs. On July 20 I took a number of pupæ from each division and placed each lot in a separate glass, with two ants from the same division. On August 30 I took four ants from the pupæ bred in B, and one from those in A (which were not quite so forward), and after marking them as usual with paint, put the B ants into nest A, and the A ant into nest B. They were received amicably and soon cleaned. Two, indeed, were once attacked for a few moments, but soon released. On the other hand, I put two strangers into nest A, but they were at once killed. For facility of observation I placed each nest in a closed box. On the 31st I carefully examined the nests and also the boxes in which I had placed them. I could only distinguish one of the marked ants, but there were no dead ants either in the nests or boxes, except the two strangers.

Some further experiments led to similar results.

These observations seem to me conclusive as far as they go, and they are very surprising. In my experiments of last year, though the results were similar, still the ants experimented with had been brought up in the nest, and were only removed after they had become pupæ. It might therefore be argued that the ants having nursed them as larvæ, recognised them when they came to maturity; and though this would certainly be in the highest degree improbable, it could not be said to be impossible. In the present case, however, the old ants had absolutely never seen the young ones until the moment when, some days after arriving at maturity, they were introduced into the nest; and yet in all ten cases they were undoubtedly recognised as belonging to the community.

It seems to me therefore to be established by these experiments that the recognition of ants is not personal and individual; that their harmony is not due to the fact that each ant is individually acquainted with every other member of the community.

At the same time the fact that they recognise their friends even when intoxicated, and that they know the young born in their own nest even when they have been brought out of the chrysalis by strangers, seems to indicate that the recognition is not effected by means of any sign or password.

Workers breeding.—In my last paper I brought forward some strong evidence tending to show that when workers laid eggs they always produced males. This is, however, a physiological fact of so much interest that I have carefully watched my nests this year also, to see what further light they would throw on the subject. In six of those which contained no queen eggs were produced, which of course must necessarily have been laid by workers belonging to *Lasius niger*, *Formica cinerea*, *Formica fusca* and *Polyergus rufescens*.

The result was that in five of these nests males have been produced, and in not a single case has a worker laid eggs which have produced a female, either a queen or a worker. Perhaps I ought to add that workers are abundantly produced in those of my nests which possess a queen. Again, as in previous years, so this season again, while great numbers of workers and males have come to maturity in my nests, not a single queen has been produced. We have, I think, therefore, strong reason for concluding that, as in the case of bees, so also in ants, some special food is required to develop the female embryo into a queen.

As to Hearing and Experiments with Telephone.—In order to ascertain if possible whether ants made any sounds which were audible to one another, I thought I would try the telephone. Accordingly I looked for two ants' nests (*Lasius niger*) not far from one another, and then, after disturbing one of them, had a telephone held just over it. I then held the second telephone close over the other nest, each telephone being

perhaps one to two inches above the ground. If the disturbed ants made any sound which was transmitted by the telephone, the ants in the other nest ought to have been thrown into confusion. I could not, however, perceive that it made the slightest difference to them. I tried the experiment three or four times, always with the same result. I then put some syrup near a nest of *L. niger*, and when several hundred ants were feeding on the syrup I blew on the nest, which always disturbs them very much. They came out in large numbers and ran about in great excitement. I then held one end of the telephone over the nest, the other over the feeding ants, who, however, took not the slightest notice. I cannot, however, look on these experiments as at all conclusive, because it may well be that the plate of the telephone is too stiff to be set in vibration by any sounds which ants could produce.

On the Treatment of Aphides.—Our countryman Gould, whose excellent little work on ants [1] has hardly received the attention it deserves, observes that "the queen ant [he is speaking of *Lasius flavus*] lays three different sorts of eggs: the slave, female, and neutral. The two first are deposited in the spring, the last in July and part of August; or, if the summer be extremely favourable, perhaps a little sooner. The female eggs are covered with a thin black membrane, are oblong, and about the sixteenth or seventeenth part of an inch in length. The male eggs are of a more brown complexion, and usually laid in March."

Here however our worthy countryman fell into an error, the eggs which he thus describes not being those of ants, but, as Huber correctly observed, of Aphides.[2] The error is the more pardonable, because the ants treat these eggs exactly as if they were their own, guarding and tending them with the utmost care. I first met with them in February, 1876, and was much astonished, not being at that time aware of Huber's observations. I found, as Huber had done before me, that the ants took the greatest care of these eggs, carrying them off to the lower chambers with the utmost haste when the nest was disturbed. I brought some home with me and put them near one of my own nests, when the ants carried them inside. That year I was unable to carry my observations further. In 1877 I again procured some of the same eggs, and offered them to my ants, who carried them into the nest, and in the course of March I had the satisfaction of seeing them hatch into young Aphides. M. Huber however does not think these are mere ordinary eggs. On the contrary he agrees with Bonnet "that the insect, in a state nearly perfect, quits the body of its mother in that covering which shelters it from the cold in winter, and that it is not, as other germs are, in the egg surrounded by food, by means of which it is developed and supported. It is nothing more than an asylum of which the Aphides born at another season have no need; it is on this account some are produced naked, others enveloped in a covering. The mothers are not then truly oviparous, since their young are almost as perfect as they ever will be, in the asylum in which Nature has placed them at their birth." [3]

This is, I think, a mistake. This is not the opportunity to describe the anatomy of the Aphis; but I may observe that I have examined the female, and find these eggs to arise in the manner so well described by Huxley in our *Transactions*,[4] and which I have also myself observed in other Aphides and in allied genera.[5] Moreover I have opened the eggs themselves, and have also examined sections, and have satisfied myself that they are true eggs containing ordinary yelk. If examined while still in the ovary the germ-vesicle presents the usual appearance, but in laid eggs I was unable to detect it. So far from the young insect being "nearly perfect," and merely enveloped in a protective membrane, no limbs or internal organs are present. These bodies are indeed real ova, or pseudova; and the young Aphis does not develop in them until shortly before they are hatched.

When my eggs hatched I naturally thought that the Aphides belonged to one of the species usually found on the roots of plants in the nests of *Lasius flavus*. To my surprise, however, the young creatures made the best of their way out of the nest, and indeed were sometimes brought out by the ants themselves. In vain I tried them with roots of grass, &c.; they wandered uneasily about, and eventually died. Moreover they did not in any way resemble the subterranean species. In 1878 I again attempted to rear these young Aphides; but though I hatched a great many eggs, I did not succeed. This year however I have been more fortunate. The eggs commenced to hatch the first week in March. Near one of my nests of *Lasius flavus*, in which I had placed some of the eggs in question, was a glass containing living specimens of several species of plant commonly found on or around ants' nests. To this some of the young Aphides were brought by the ants. Shortly afterwards I observed on a plant of daisy, in the axils of the leaves, some small Aphides very much resembling those from my nest, though we had not actually traced them continuously. They seemed thriving, and remained stationary on the daisy. Moreover, whether they had sprung from the black eggs or not, the ants evidently valued them, for they built up a wall of earth round and over them. So things remained throughout the summer; but on October 9 I found that the Aphides had laid some eggs exactly resembling those found in the ants' nests; and on examining daisy-plants from outside I found on many of them similar Aphides, and more or less of the same eggs.

I confess these observations surprised me very much. The statements of Huber have not indeed attracted so much notice as many of the other interesting facts which he has recorded; because if Aphides are kept by ants in their nests, it seems only natural that their eggs should also occur. The above case however is much more remarkable. Here are Aphides, not living in the ants' nests, but outside, on the leaf-stalks of plants. The eggs are laid early in October on the food-plant of the insect. They are of no direct use to the ants, yet they are not left where they are laid, where they would be exposed to the severity of the weather and to innumerable dangers, but brought into their nests by the ants, and tended by them with the utmost care through the long winter months until the following March, when the young ones are brought out and again placed on the young shoots of the daisy. This seems to me a most remarkable case of prudence. Our ants may not perhaps lay up food for the winter, but they do more, for they keep during six months the eggs which will enable them to procure food during the following summer.

No doubt the fact that our European ants do not generally store up food in the usual way is greatly due to the nature of their food. They live, as we know, partly on insects and other small animals which cannot be kept fresh; and they have not learnt the art of building vessels for their honey, probably because they are not kept in cells like those of the honey-bee, and their pupæ do not construct firm cocoons like those of the humble-bee.

Moreover it is the less necessary for them to do so, because if they obtain access to any unusual store of honey, that which they swallow is only digested by degrees and as it is required; so that, as the camel does with water, they carry about with them in such cases a supply of food which may last them a considerable time. They have moreover, as we know, the power of regurgitating this food at any time, and so supplying the larvæ or less fortunate friends. Even in our English ants the quantity of food which can be thus stored up is considerable in proportion to the size of the insect; and if we watch, for instance, the little brown garden-ant (*Lasius niger*) ascending a tree to milk their Aphides, and compare them with those returning full of honey, we shall see a marked difference in size.

We have, indeed, no reason to suppose that in our English ants any particular individuals are specially told off to serve as receptacles of food. W. Wesmael, however, has described [1] a remarkable genus (*Myrmecocystus mexicanus*), brought by M. de Normann from Mexico, in which certain individuals in each nest serve as animated honey-pots. To them the foragers bring their supplies, and their whole duty seems to be to receive the honey, retain it, and redistribute it when required. Their abdomen becomes enormously distended, the intersegmental membranes being so much extended that the chitinous segments which alone are visible externally in ordinary ants seem like small brown transverse bars. The account of these most curious insects given by MM. de Normann and Wesmael has been fully confirmed by subsequent observers; as, for instance, by Lucas,[2] Saunders,[3] Edwards,[4] Blake,[5] Loew,[6] and McCook.

1 "An Account of English Ants." By the Rev. W. Gould, 1747, p. 36.
2 My lamented friend Mr. Smith also observed these eggs (*Entom. Annual*, 1871). He did not however identify the species to which they belonged.
3 "The Natural History of Ants." By M. P. Huber, 1820, p. 246.
4 *Trans.* Linn. Soc., vol. xxii. 1859.
5 *Philosophical Transactions*, 1859.

1 *Bull. de l'Acad. des Sci. de Bruxelles.*
2 *Ann. Soc. Ent. de France*, v. p. 111.
3 *Canadian Entomologist*, vol. vii. p. 12.
4 *Proc.* Californian Academy, 1873.
5 *Ibid.* 1874.
6 *American Nat.* viii. 1874.

On one very important point, however, M. Wesmael was in error; he states that the abdomen of these abnormal individuals "ne contient aucun organe; ou plutôt, il n'est lui-même qu'un vaste sac stomacal." Blake even asserts that "the intestine of the insect is not continued beyond the thorax," which must surely be a misprint; and also that there is no connection "between the intestine and the cloaca"! These statements, however, are entirely erroneous; and, as M. Forel has shown, the abdomen does really contain the usual organs, which, however, are very easily overlooked by the side of the gigantic stomach.

I have now the honour of exhibiting to the Society a second species of ant, which has been sent me by Mr. Waller, in which a similar habit has been evolved and a similar modification has been produced. The two species, however, are very distinct, and the former is a native of Mexico, while the present comes from Adelaide in Australia. The two species, therefore, cannot be descended one from the other; and it seems inevitable that the modification has originated independently in the two species.

It is interesting that, although these specimens apparently never leave the nest, and have little use therefore for legs, mandibles, &c., the modifications which they have undergone seem almost confined to the abdominal portion of the digestive organs. The head and thorax, antennæ, jaws, legs, &c., differ but little from those of ordinary ants.

CAMPONOTUS INFLATUS, n. sp.

Operaria. Long. 15 mill. Nigra, tarsis pallidioribus; subtiliter coriacea, setis cinereo-testaceis sparsis; antennis tibiisque haud pilosis; tarsis infra hirsutis; mandibulis punctatis, hirsutis, sexdentatis; clypeo non carinato, antice integro; petioli squama modice incrassata, antice convexa, postice plana emarginata.

Hab. Australian.

The colour is black, the feet being somewhat paler. The body is sparsely covered with stiff cinereo-testaceous hairs, especially on the lower and anterior part of the head, the mandibles, and the posterior edge of the thorax. The head and thorax are finely coriaceous.

The antennæ are of moderate length, twelve-jointed; the scape about one-third as long as the terminal portion and somewhat bent. At the apex of the scape are a few short spines, bifurcated at the point. At the apex of each of the succeeding segments are a few much less conspicuous spines, which decrease in size from the basal segments outwards. The antenna is also thickly clothed with short hairs, and especially towards the apex with leaf-shaped sense-hairs. The clypeus is rounded, with a slightly developed median lobe and a row of stiff hairs round the anterior border; it is not carinated. The mandibles have six teeth, those on one side being rather more developed and more pointed than those on the other. They decrease pretty regularly from the outside inwards. The maxillæ are formed on the usual type. The maxillary palpi are six-jointed, the third segment being but slightly longer than the second, fourth, or fifth; while in *Myrmecocystus* the third and fourth are greatly elongated. The segments of the palpi have on the inner side a number of curious curved blunt hairs besides the usual shorter ones. The labial palpi are four-jointed. The eyes are elliptical and of moderate size. The ocelli are not developed.

The thorax is arched, broadest in front, without any marked incision between the meso- and metanotum; the mesonotum itself is, when seen from above, very broadly oval, almost circular, rather broader in front and somewhat flattened behind. The legs are of moderate length, the hinder ones somewhat the longest. The scale or knot is heart-shaped, flat behind, slightly arched in front, and with a few stiff, slightly diverging hairs at the upper angles. The length is about two-thirds of an inch.

ON THE THERMIC AND OPTIC BEHAVIOUR OF GASES UNDER THE INFLUENCE OF THE ELECTRIC DISCHARGE[1]

PROF. E. WIEDEMANN has undertaken an exact calorimetric investigation of the electric discharge through gases, and in spite of the serious difficulties which he had to encounter, he has already obtained valuable and important results. As a source of electricity, Töpler's machine was used; but we must refer to the original paper for all details of experimentation.

Three series of observations were made. In the first the total heat generated in a given time in the whole vacuum tube was measured. In the second series the capillary part only was examined, and in the third the thermal behaviour of the regions in the neighbourhood of the electrodes was investigated. The result of the first series is summed up as follows:—With decreasing pressure the total quantity of heat generated at first decreases, reaches a minimum, and then increases again. In hydrogen the amount of heat generated is smaller than in atmospheric air.

A smaller amount of heat developed corresponds to a larger number of discharges in a given time, and hence to a smaller potential at the moment the discharge begins to pass. The results of Prof. Wiedemann are therefore, as he points out, in accordance with those of Messrs. De La Rue and Hugo Müller, who found that the difference of potential necessary to cause a discharge passes through a minimum as the pressure decreases.

Somewhat more complicated results were obtained when an air-break was introduced into the circuit. In that case the air-break determines the difference of potential necessary to produce a discharge; but if the whole quantity of electricity would pass suddenly when that potential has been reached, and before it has had time to sink, the amount of heat generated would be independent of the pressure in the vacuum tube. This however is not the case; but the result is intermediate between that obtained when no air-break exists, and that which would be obtained on the above supposition.

The following results were obtained in the experiments in which the capillary part of a vacuum tube only was introduced into the calorimeter:—

1. The heating effect in capillary tubes at pressures above 1 mm. is almost independent of the quantity of electricity passing with each discharge, and nearly proportional to the total amount of electricity which passes.

2. The heating effect is almost the same whether the positive or negative electrode of the tube is connected with the machine (the other electrode being connected with the earth), although the number of discharges passing in a given time is different.

3. With decreasing pressure the heat generated decreases very rapidly without passing through a minimum.

4. The heating effect is independent of the shape of the electrodes. Some results obtained by Prof. G. Wiedemann, who had found that in tubes of different widths the same amount of heat is generated by the same current, were confirmed.

Calorimetric measurements made near the electrodes showed:

1. The heating effect near the positive electrode decreases with decreasing pressure rapidly. At very low pressures a small increase is sometimes observed.

2. The heating effect near the negative electrode decreases first with decreasing pressure, and then increases rapidly.

The heating effect near the positive electrode shows some anomalies when an air-break is introduced, the amount of heat generated being considerably increased.

Some measurements were reduced to an absolute scale, and showed that the total amount of heat generated is very large. Taking account of the number of discharges, and assuming that after each discharge the gas returns to its original state, the temperature in the capillary part of the tube must have been about 2,000° C. at 15 mm. pressure, and about 1,100° C. at 5 mm. pressure. If the width of the tube was increased ten times, the temperature would only be about 100° C., and this confirms the result obtained by Prof. Wiedemann in a former investigation, that gases may become luminous under the influence of the electric discharge at a comparatively low temperature.

In another part of the paper Prof. Wiedemann treats of a very important problem. When his tubes were filled with hydrogen, and an air-break was introduced in the circuit, the spectrum of the luminous gas changed suddenly at a given point. According to a now generally accepted hypothesis this change of spectrum is always accompanied by a change in the molecular constitution of the gas; and it is to be expected therefore that heat is either absorbed or given out by a gas when its spectrum changes. This heat Prof. Wiedemann has endeavoured to measure. Let us imagine, for instance, that the current has to do the work of decomposing the molecules of a gas. The moment the discharge has passed, recomposition will take place, and the heat then generated was measured by Prof. Wiedemann. Some of the suppositions on which the calculations are based might require further investigation, but the assumptions made are supported, and to a certain extent proved by the fact that the heat necessary to change the band-spectrum into the line-spectrum was found to be *independent of the pressure and cross-section of the tube.* It is

[1] By Eilhard Wiedemann. (*Wied. Ann.*, x. p. 202.)

clear that Prof. Wiedemann's line of investigation would afford an absolute proof that the changes of spectra are really due to the causes to which they are now hypothetically referred by the majority of observers. It is however rather unfortunate that in the particular case under discussion the chemical origin of the band-spectrum has not been settled to the general satisfaction of all observers. A good many of them believe the spectrum to be due to a hydrocarbon, and in that case Prof. Wiedemann would simply have measured the heat of combustion of hydrogen and carbon. No doubt Prof. Wiedemann will extend his measurements to other gases for which the spectroscopic difficulties have been more satisfactorily settled.

Prof. Wiedemann has also investigated some phenomena in vacuum tubes, which have also been partly discussed by other observers. Thus under certain conditions more exactly investigated by Messrs. Spottiswoode and Moulton, it is known that a conductor of electricity brought near a vacuum tube will deflect the discharge. Prof. Wiedemann finds, as had already been previously noticed by Mr. Goldstein, that the point touched by the conductor behaves like a negative electrode. It is known that as a rule the rays proceeding from a negative electrode are propagated in straight lines, and do not turn round a corner. An experiment however is mentioned by Prof. Wiedemann, in which an exception to this rule seems to take place; but Prof. Wiedemann himself suggests that secondary phenomena might have influenced the result. Perhaps an explanation is to be found in the fact proved by Mr. Goldstein, that when two tubes of different width are fused together the point of junction behaves like a negative electrode.

Some experiments were made to show that the rays producing the phosphorescence can traverse the positive discharge; also to prove that when the pressure is very small the shape of the electrodes has a great influence on the number of discharges and on the other phenomena attending them.

Prof. Wiedemann winds up with some interesting speculations on the nature of the discharge of electricity through gases, but it was our object to give an account only of his experimental results. A theoretical discussion would lead us too far, as we should have to take account of other writings which have lately appeared. We may return to this part of the subject on another occasion. It is evident from the account we have given that the calorimetric methods employed by Prof. Wiedemann have enabled him to take a very material step towards the elucidation of a difficult problem, and we may hope for another series of his valuable measurements. ARTHUR SCHUSTER

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

EDINBURGH.—The Baxter Physical Science Scholarship of 116*l.*, conferred by the University of Edinburgh on the most eminent B.Sc. who has taken his degree during the present or the preceding year, has been awarded to Mr. D. Orme Masson, lecturer on Chemistry at University College, Bristol, who is prevented from accepting it in consequence of holding his present appointment.

THE system of Fellowships in the Johns Hopkins University is of considerable interest. Twenty Fellowships, each yielding five hundred dollars, are annually open to competition in this University. The system of Fellowships was instituted for the purpose of affording to young men of talent from any place an opportunity to continue their studies in the Johns Hopkins University, while looking forward to positions as professors, teachers, and investigators, or to other literary and scientific vocations. The appointments have not been made as rewards for good work already done, but as aids and incentives to good work in the future; in other words, the Fellowships are not so much honours and prizes bestowed for past achievements, as helps to further progress, and stepping-stones to honourable intellectual careers. They have not been offered to those who are definitely looking forward to the practice of either of the three learned professions (though such persons have not been formally excluded from the competition), but have been bestowed almost exclusively on young men desirous of becoming teachers of science and literature, or determined to devote their lives to special branches of learning which lie outside of the ordinary studies of the lawyer, the physician, and the minister. Every candidate is expected to submit his college diploma or other certificate of proficiency from the institution where he has been taught, with recommendations from those who are qualified to speak of his character and attainments. But this is only introductory. He must also submit, orally or in writing, such evidence of his past success in study and of his plans for the future, together with such examples of his literary or scientific work as will enable the professors to judge of his fitness for the post. The examination is indeed in a certain sense competitive; but not with uniform tests, nor by formal questions and answers submitted to the candidates. First, the head of a given department considers, with such counsel as he may command, the applicant's record. The professors then collectively deliberate on the nominations made by individual members of their body. The list upon which they agree, with the reasons for it, is finally submitted by the president of the University to the Executive Committee, and by them to the trustees for final registration and appointment. By all these precautions the highest results which were anticipated have been secured. A company of most promising students has been brought together, and their ability as teachers and scholars has been recognised by the calls they have received to permanent and attractive posts in different parts of the country.

A SPECIAL feature of Russian universities is that the students mostly belong to the poorer classes, and that they earn the means of existence by teaching or by translating foreign works for the monthly reviews. Thus, at the same time as the foundation stone of the Siberian University was laid at Tomsk, a subscription was raised for the erection of a building in which gratuitous lodgings might be given to students. The well-known explorer of Western Siberia, M. Yadrintzeff, immediately after his return from his last journey, delivered a series of lectures on the scenery of Altay, to raise funds for that purpose.

THE new university at Tomsk will be most liberally endowed. Up to the day of laying the foundation-stone 354,000 roubles (about 53,000*l.*) had been received for the building, 100,000 roubles (15,000*l.*) for teaching utensils, and 31,000 roubles (4600*l.*) for stipendia. A library of more than 35,000 volumes is ready, and only waiting the building of the necessary apartments to house it.

SCIENTIFIC SERIALS

Trimen's Journal of Botany, October, 1880–January, 1881.—Among the more valuable articles in the most recent numbers of this journal may be mentioned:—*Musci præteriti* (new or badly-described mosses), by R. Spruce.—An account of the Acanthaceæ of Dr. Welwitsch's Angolan herbarium, by S. Le M. Moore, with descriptions of a number of new species.—On *Manihot Glaziovii*, the plant affording Ceara india-rubber, by Dr. Trimen.—On a collection of Madagascan ferns, by J. G. Baker.—On *Chara obtusa* (*stelligera* Bauer), a species new to Britain, by H. and J. Groves.—The history of the scorpioid cyme, by Dr. S. H. Vines.—On the plants of North Aran Island, co. Donegal, by H. C. Hart; with a number of interesting shorter notices and articles.

Journal of the Royal Microscopical Society, vol. iii. No. 6 for December, with special index number, contains—The Transactions of the Society.—Charles Stewart, on some structural features of *Echinostrephus molare*, *Parasalenia gratiosa*, and *Stomopneustes variolaris*, with plate 20.—Dr. H. Stolterfoth, on the diatomaceæ in the Llyn Arenig Bach deposit.—Dr. G. W. Royston-Pigott, on a new method of testing an object-glass used as a simultaneous condensing illuminator of brilliantly reflecting objects such as minute particles of quicksilver.—The record of current researches relating to invertebrata, cryptogamia, microscopy, &c.—The year's journal forms a volume of over 1100 pages, of which less than 200 are filled with the Transactions of the Society, and over 800 with the increasingly useful record. With the February number will commence a new series.

SOCIETIES AND ACADEMIES

LONDON

Zoological Society, January 4.—Prof. W. H. Flower, LL.D., F.R.S., president, in the chair.—Mr. Sclater exhibited and made remarks on a skin of the Southern Merganser (*Mergus australis*) from the Auckland Islands, belonging to the collection of Baron Anatole von Hügel.—Prof. A. Newton, M.A., F.R.S., exhibited on behalf of Prof. Alphonse Milne-Edwards, F.M.Z.S., an egg of *Coriama cristata*, laid last summer in the Jardin des

Plantes, and possibly the first ever seen of which the parentage was certainly known, though an egg, also exhibited by Prof. Newton, had been for many years in the collection of Mr. H. F. Walter.—Dr. Albert Günther, F.R.S., read an account of the zoological collections made by Dr. R. W. Coppinger, R.N., during the survey of H.M.S. *Alert* in the Straits of Magellan and on the coast of Patagonia, and called attention to the most remarkable species represented in the various groups, which had been worked out by himself and his assistants in the Zoological Department of the British Museum. Dr. Günther also called attention to several interesting cases of the similarity of forms in these collections to known forms of the Arctic regions and of the Australian seas.—A communication was read from Prof. J. O. Westwood, containing the descriptions of some new exotic species of moths of the genera *Castnea* and *Saturnia*.—A second paper by Prof. Westwood contained observations on two Indian butterflies—*Papilio castor* and *P. pollux*.—Prof. W. H. Flower, F.R.S., described the skull of a very large elephant seal (*Macrorhinus leoninus*), lately received in the Museum of the College of Surgeons from the Falkland Islands, and discussed the questions of affinities and systematic position of this animal among the Pinnipeds. Prof. Flower arrived at the conclusion from an examination of its dental, cranial, and limb characters, and from some other points in its anatomy, that the elephant seal is the member of the group the farthest removed from the terrestrial carnivora and showing most cetacean analogies. He also considered that at present there is no evidence of the existence of more than one species of the genus.—Dr. A. Günther read some notes on the species of insectivorous mammals belonging to the genus *Rhynchocyon* and *Petrodromus*, and described two new species of the former genus, proposed to be called *R. macrurus* (from the Rovuma River), and *R. chrysopygus* (from the Mombaça River).

PARIS

Academy of Sciences, January 3.—M. Wurtz in the chair.—M. Jamin was elected Vice-President for 1881, and MM. Decaisne and Edm. Becquerel were elected Members of the Central Administrative Committee.—M. Becquerel gave information as to the Academy's publications, and the changes among members and correspondents. Two members have died during the year, M. Chasles and General Morin; and seven correspondents, MM. Borchardt, Peters, Lissajous, Favre, Miller, Schimper, and Mulsant.—The following papers were read:—On magnetic oxide of iron, by M. Berthelot. The heat liberated in fixation of oxygen by iron decreases (for a given quantity of oxygen) as we pass from the protoxide to the magnetic oxide, then to the peroxide.—Researches of M. Fourier on the fall of the barometer in cyclones, by M. Faye. M. Fournier gives a formula for the progress of the barometer, and shows its validity by observations at the Island of Réunion.—Mr. Gould was elected Correspondent in Astronomy, in room of the late M. Peters.—On observations of the satellites of Jupiter at Toulouse Observatory in 1879, by M. Baillaud.—On a process of astronomical observation for the use of voyagers, dispensing with the measurement of angles for determination of latitude and of sidereal time, by M. Rouget. This is by observing two stars that have at a given moment the same altitude; combining such observations in pairs, and noting the interval between the two phenomena, &c.—Determination of the lines of curvature of all the surfaces of the fourth class, correlatives of cyclides, which have the circle of infinity for double line, by M. Darboux.—Measurement of the electromotive force of batteries, by M. Baille. He uses a torsion balance having a long wire (2·70m.) of annealed silver, and a lever with balls of gilt copper at each end. Similar balls are fixed at the angles of a rectangle, and diagonal pairs are in communication with each other. The lever, placed at equal distance from the fixed balls, is connected through the torsion wire with the + pole of a battery, the other pole being to earth. One pole of the pile to be measured is connected with the fixed balls. The deflections are read by reflection of an illuminated glass scale. The apparatus is enclosed in a metallic case connected with the ground. A thick envelope of wood-shavings is used to exclude disturbances from heat.—On the velocity of light: reply to M. Cornu, by M. Gouy.—Study on spectrophotometers, by M. Crova. Two spectra from different sources may be easily compared by covering half the slit of a photometric spectroscope with a small rectangular prism, the edge of which cuts the slit normally into two equal parts; one half receives one of the lights directly, the other, by total reflection, the other light placed laterally. Aberration can be corrected with a cylindrical lens. The elliptic polarisation from total reflection may be suppressed, by replacing a simple prism by two total reflection prisms superposed in contact.—On a method of reproducing speech in electric condensers, and particularly in the singing condenser, by M. Dunand. He connects one pole of a battery with one end of the induced wire of the coil, the other pole with one armature of the condenser, while the second armature is attached to the other end of the induced wire. (In the circuit of the primary coil are a battery and carbon microphone). In this way speech may be reproduced with perfect distinctness. The condenser giving the best effects was 0·06m. in length of side; it contained thirty-six sheets of tin-foil. For the auxiliary battery two or three (Leclanché) elements will give weak articulate sounds. The intensity increases with increase of the number of elements, but not proportionally. The current of the auxiliary coil does not traverse the condenser.—M. du Moncel made some remarks on the subject.—On the vapour-density of iodine, by MM. Crafts and Meier. They study the variation of the density with the tension and with the temperature. The facts agree with the hypothesis of progressive dissociation.—On the direct preparation of chlorised and bromised derivatives of the methylic series, and especially of chloroform and bromoform, by M. Damoiseau.—On the functions of the small oblique muscle of the eye in man, by M. Fano.—Facts for the study of formation of fogs, by M. André. This relates to a case in which a high barometer was observed to sink suddenly (with rain), while a fog present disappeared; with slow rise of the barometer the fog reappeared.—New eruption of Manua-Loa (Hawaiian Islands), by Mr. Green. This was on November 9.—On the formation of a thin layer of ice on the sea observed at Smyrna during the winter of 1879, by M. Carpentin. A slight breeze seems to have driven the waters of the Guedyzé against the quays of Smyrna, and there formed a thin layer on the surface, which froze in a complete calm on a clear night.—On a new use of electricity, by M. Grandt. This is, propelling vessels. A steam-engine drives one or more electro-dynamic induction apparatuses; the current is sent through a voltameter; the gases are conducted to an orifice in the keel, and exploded by an induction spark, with propulsive effect.

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