THURSDAY, AUGUST 27, 1896.

PROFESSOR OSTWALD ON ENGLISH AND GERMAN SCIENCE.

PROF. RAMSAY has done good service by communicating to the *Times* a letter he has received from Prof. Ostwald of the highest importance at the present time, when, fortunately for us, German supremacy along many lines of applied science and the causes of it, are being at last recognised.

No one has a better right to speak on this subject than Prof. Ostwald, and the fact that we may take his communication as one made in the interests of British science makes it all the more valuable.

What he says will be no news to the readers of NATURE, because for years past we have been pointing out the rocks ahead and the steps necessary to avoid them; but our voice has been as that of one crying in the wilderness. Fortunately for us this is so no longer. The *Times* devotes a leader to Dr. Ostwald's letter, which we give in another column, but it does not appear that even the *Times* is in real touch with the actual position.

"The Germans have found that nothing pays so well as knowledge, and that new knowledge always pays in the long run. They act on this principle by maintaining a steady demand for men competent to extend the domain of theoretical knowledge, paying them well for doing it, and taking their chance of one valuable practical discovery turning up among a score that for the present lead to nothing. How good that chance is may be judged from the enormous success attending German chemical industries of all kinds. Germany controls the fine chemical markets of the world, and that means that she takes tax and toll of almost every industry in every country. How easily we might have forestalled her can be fully understood only by those who know what a splendid start we had in capital, in machinery, in control of markets, and in root ideas. Some of her most lucrative industries have been developed out of English discoveries, due to the genius of individual Englishmen, but never properly grasped and worked out by English manufacturers. Her commercial domain will go on extending, and ours proportionately shrinking, unless Englishmen become practical enough to look beyond their noses, and wise enough to believe in knowledge."

This is excellent; but then we are also told—

"For any healthy reform we want driving power, and the driving power must come from manufacturers enlightened enough to understand the secret of German success and English failure. It is industry that must endow research, not from any unpractical desire to add to the number of useless persons who know all that has been done, yet do not know how to do anything new, but from the very practical desire of manufacturers to extend their business and add to their profits."

And again:—

"There is a clamour now and again for State aid, and Dr. Ostwald's letter will, perhaps, stimulate it, because he refers to the action of the State in Germany. But the root of the matter in Germany lies in private enterprise, and it must do so here. Heaven helps those who help themselves, and the State cannot do better than observe the same limitation. When industry endows research it will be time to ask for assistance from the taxpayer. Until then State endowment of research can mean little more than throwing money away upon abstract acquirements having no real relation to the facts of national prosperity."

Let us accept for a moment that "industry," "manufacturers," and "private enterprise" in Britain at once proceed to do all that the *Times* lays at their doors. What then? Prof. Ostwald answers this question by telling us what the Prussian Government and the various German States have done and are doing for research and scientific education, above and beyond all the efforts made by German "industry," "manufacturers," and "private enterprise."

In such a competition Britain, without the State aid so amply and wisely given in Germany, is certain to lose.

It has already been pointed out in these columns, and it is worth while to re-state it, that the connection between our national greatness, our national defences, and our commerce, is universally recognised, and that the State spends, and properly spends, tens of millions a year, the protection of our commerce being assigned as one of the ostensible reasons.

But another thing which as yet is not generally recognised is that so surely as our national greatness is based upon our industries, as surely in the future must our industries be based upon science.

It is clear, therefore, that if in other countries the advancement of science is the duty not only of individuals, but of States, mere individual effort in any one country must be crushed out in the international competition which is growing keener and keener every day.

Taking things as we find them, we spend tens of millions a year to protect our commerce which is a measure of our industries; while the basis of these, science, is to remain unprotected, unorganised, and unaided, except by local efforts and the action of individuals.

Surely such a contention cannot be seriously maintained—such inconsistent action can have no logical basis. The real remedy lies in consistently organising both our peace and our war forces, as Huxley pointed out many years ago. We have now a War or Industries-protecting Council: by the side of it we want a Peace or Industries-producing Council; in other words, a strong Minister of Science, who shall have as complete a staff of men of science to advise him as the President of the War Council finds himself provided with in the heads of the Army and Navy Departments.

Only in this way can Germany's flank be turned. If it were only a question of ironclads how readily everybody would agree.

Another part of Prof. Ostwald's letter, for which thanks are due, is that in which he points out that in Germany research is as important an engine in Education as it is in a Chemical Works; so that again the call upon "private enterprise" is not sufficient.

Here, of course, the whole question of our University organisation is raised. We cannot pursue it now, but we may quote a pregnant passage from Prof. Fitzgerald's letter, also printed elsewhere—

"The most serious cause of complaint of modern society against the old universities is that they have so controlled the education of the wealthy classes of the community, that the landed and professional classes have been educated apart from the commercial and industrial classes, to the very great injury of both."

This is the reason that the true condition of things has not been appreciated long ago. It is not understood, and therefore it is not believed. Our political leaders, the permanent chiefs of the various public departments, have not the slightest idea what all this fuss is about, because their education has been entirely apart from those regions of thought and work in which in the future the peaceful battles of the world will be fought and won; if not by us, then by others, for fighting there must be.

No better argument could be found for the establishment of a ministry and council of science than was afforded by two speeches delivered some little time ago by the Duke of Devonshire on matters connected with scientific education, and of which condensed reports were given in NATURE at the time. The Duke candidly confessed at Birmingham that he was not placed at the head of the educational and scientific affairs of the country on account of any special knowledge of the subjects, for "his knowledge of science and art could be compressed into two nutshells." It is not our desire to utter one word against the Duke of Devonshire for his candour; he has shown that he is interested in technical education, and has on more than one occasion assisted the work of science. But what we do criticise is the political system which does not consider it necessary that the educational and scientific welfare of the country should be the business of those who are able to appreciate the work done, to see the necessity of reforms, and to know the directions in which developments should take place. In almost every other country the State or Government has official men of science among its servants, and also constantly ask the advice and assistance of their academies and learned societies, when questions of technical and scientific interest are being discussed; but here no such use is made, either of the societies as a whole or of the men who constitute them.

CARL VOGT.

La Vie d'un Homme: Carl Vogt. By William Vogt. 4to vol. of 264 pages, with two portraits by Otto Vautier. (Schleicher Brothers, *ex*-Reinwald. Paris, 1896.)

A PHILOSOPHER he was—there is no doubt about that; but none of the quiet sort who "leave controversy to the little world below them": he was one of the fighting portion, and while none have known him to step out of his path to avoid a skirmish, he has often gone far from his track for the mere pleasure of picking up some battle. To him life was movement, and a true account of his years should include more than the history of his scientific work. The latter has been reviewed in NATURE for May 30, 1895, and a very full account thereof has been also given by his pupil and friend, Emile Yung, in *Revue Scientifique*, dated June 22, 1895. M. William Vogt, his son, now proceeds to tell us the essentials of his life; and although the large book before us deals but slightly with the scientific features of the lamented naturalist, still scientific readers will find much in it to interest them, in the way of anecdotes concerning Vogt's relations with men of his time, and letters of the latter.

Carl Vogt was born on July 5, 1817, at Giessen, in Germany, the eldest of nine children. Celtic blood was predominant in his veins, not Germanic, and much in his character and wit was distinctively Celtic. The son of a distinguished physician and professor, Carl had an uneventful youth. To put it short, he was lazy, and Gall could certainly not locate the "bump of respect" or of submissiveness on that head. His father was assured that the masters allowed him to pass from class to class, each year, only to get rid of this turbulent and undisciplined pupil; and it is well known that the aforesaid "bump" never grew. After the school-days, Carl was sent to the medical faculty, where he did more fighting and duelling than reading or study, and entered Liebig's laboratory. He was engaged in an investigation of the amniotic liquid (published in Müller's *Archiv*, 1837), when an event occurred which stands at the basis of all Vogt's political troubles. A law student, implicated in the Marburg plot, and a republican, begged of Vogt to help and conceal him, as the police were in search of him. Vogt—a nephew of the three republican brothers Follenius—complied immediately, and hid his fellow-student in his own room, although the next day it was officially announced that five years' imprisonment in a fortress was the penalty for such offence. A week elapsed, quietly, when one day, Liebig took Vogt aside. Liebig knew the facts, and had heard that the police also were informed; it was high time for Vogt to run. At once Vogt went home, and the same evening the refugee and himself left, in opposite directions, early enough to avoid being captured. Carl Vogt fled to an uncle of his, near Darmstadt, and spent a few weeks there, disguised by his uncle—an inspector of forests—as a forest official, and in this character taking part in the chases of the very *Gross-Herzog* himself, whose police were after Vogt. Some weeks later, he managed to cross the Rhine, and, with the help of friends, to put his feet on the French soil; he was then out of trouble. His father desired him to pursue his medical studies, and in 1839 he graduated in Bern *maxima cum laude*. But little he cared about medical art. Valentin, the physiologist and anatomist, had been interested in the young student, and wished to bring him over to zoology and physiology. Vogt took very kindly to the hints, and to Valentin's lessons, and undertook most willingly to investigate the nervous system of some South American reptiles collected by Humboldt. Hence two papers ("Neurologie von Python tigris" and "Neurologie der Reptilien," 1839-40) which are the first anatomical work of Carl Vogt, the last being more than fifty years younger. At this period, circumstances—too long to relate—put Vogt, and Edouard Desor his friend, in contact with Louis Agassiz, and they decided of Vogt's scientific future: he was bound to become a naturalist. Vogt set to work in most determined manner at Agassiz's "Poissons d'Eau douce" and at the "Embryologie des Salmonés," publishing in the meantime his interesting paper on "Alytes obstetricans." An amusing anecdote finds its place here. One day Desor, while dictating to a young *famulus* a sentence, said, in order to surprise him: "This specimen is distinguished from others (other fishes) by this characteristic, that it has the head where the others have the tail." The *famulus* never winced. The copy went to the printing-house, and the proofs came in due time. But the wonder is that, while Desor, Vogt, and Agassiz—*deus ipse*—went over the proofs and corrected them, none noticed the absurd sentence, and it is only after fifty copies had been printed off that Desor remembered his "little joke," and stopped the proceedings. Let writers be lenient towards printers and proof-readers; such is the moral of this story.

At the same time, Agassiz, aroused to the interest of glacial studies by Venetz and Jean de Charpentier, began his historical fight against Elie de Beaumont and von Buch, and, in order to settle the matter, decided to investigate glaciers thoroughly. Thus originated the Hotel des Neuchatelois expedition, when Agassiz, Desor, and Vogt settled on the Aar glacier, and made a sort of cabin under a huge boulder which had fallen from the Schreckhorn, and upon which the names of the party were scratched, still legible, in part, a few years ago. Two summers were spent there in great activity; the "Agassiz factory," as not over-respectful Vogt used to call the association, being under its highest pressure. The Neuchatel period had its outcome—as far as Vogt alone is concerned—in the publication of "Im Gebirg und auf den Gletschern," studies on the fauna of red snow, and a severe discussion with von Buch. The latter was not convinced, but bore no grudge towards the young "Mutz" ("Mutz" is Bernese *patois* for bear, a surname given to Vogt by his friends) for his attacks, and even allowed that "aus dem kerl wird noch etwas werden."

Vogt and Agassiz were not to agree very long. To ascertain the exact cause of their estrangement would prove perhaps difficult. Ernst Haeckel has been very clear and positive on one point, however, and he denounces Agassiz as having been "the most active and clever *chevalier d'industrie* who ever worked in the field of natural history," "clever" being taken in its none too favourable sense.

Agassiz seems to have practised *Ich nehm es mit* on a large scale, taking an unfair advantage of his younger co-operators, and not giving them the credit which was due to them for their share of the work. Carl Vogt and Desor accordingly retired, and the scientific partnership of the Hôtel des Neuchatelois was dissolved. This was in 1844. Paris could hardly fail to attract Vogt, and thither he directed his steps. His friends, or masters, were Ehrenberg, the revolutionist Bakounine, von Baer, Quételet, Arago, Milne-Edwards, Leverrier, de Jussieu, and many others of equal fame. Three years were spent then, at hard work. Vogt published his investigations on the development of gasteropods, and his "Lehrbuch der Geologie und Petrefactenkunde." The latter, but little known in England or in France, was much appreciated in Germany, and much read; many editions were brought out, always kept *au courant*. The last is dated 1879. In Paris also he wrote his celebrated "Physiologische Briefe," of which Russian, German French, and Italian versions are extant. The book was as loudly praised as heartily denounced. A year ago, still, a Catholic writer compared Vogt to a "murderer" for having written it, and so clearly spoken out his materialistic creed. There is no doubt as to Vogt's sincerity, but doubt may be entertained as to the necessity of some pages in his otherwise very interesting and spirited book. "The philosopher must station himself in the middle," said Goethe. Vogt was by nature extreme. On the other hand, it must be confessed that the much-abused sentence, "Thought is about in the same relation to brain, as bile to liver, or urine to kidney," is one that no physiologist can refuse to endorse, as long as he stands only on the solid ground of facts as at present ascertained.

To the same period of life belongs "Ocean und Mittelmeer," a descriptive narrative of excursions to the seashore, mingled with scientific facts. During his summer vacations, Vogt travelled on the Mediterranean coast, and while the picturesque scenery and pleasant climate of the sun-bathed shores strongly appealed to the intense feeling of the lover of nature, the naturalist was attracted by the rich and varied fauna; he therefore decided, *hic et nunc*, to pursue his investigations; Nice was even better than Paris. Here was performed most of the work which ended in the publication of many papers on Cephalopods (with Vérany), on Siphonophora, and Ascidians. In 1846, kind Liebig, who had kept an attentive eye on his former pupil's doings, wrote to offer him a position. The Giessen University was to have a chair of Zoology; would he come and fill it? Certainly, answered Vogt. But there were difficulties. The Government was—for reasons of old, already told—no friend to the republican "Mutz," whose "Physiologische Briefe" were to many a permanent scandal; and Liebig's proposal would have been rejected, had it not been for old von Buch's and Humboldt's personal intervention. Agassiz also helped actively, and in 1847 Carl Vogt, the police-tracked student of 1837, entered Giessen as Professor of Zoology. It would seem that the *wanderjahre* were now over, and that the hot-headed young man was to settle down quietly in his chair, to grow fat and bald, and conservative, and optimistically smile upon the world, sitting down and doing nothing, or little. Such is often the case; but with Vogt, otherwise.

His first act was a scandal to the peaceful community of Giessen: he refused to shave, as university professors were required to. And then, 1848 was approaching; the storm was brewing, and how could Vogt not be attracted by the prospective trouble? A member of the dissolved *Vorparlament*—all this story cannot be abridged, so it is simply omitted—Carl Vogt was re-elected as antagonistic to the Conservative Government, and during a few days he was one of the *Reichs-regents*—part of an emperor. But the republicans were crushed by superior forces, and the revolution was checked. Vogt had to take leave—his chair was handed over to Rudolph Leuckart—and he sought a refuge in Switzerland, and shortly after in Nice. Politics were, for the time being, dismissed, and zoology again carried the day. At least, *Bilder aus dem Thierleben*, and papers on different invertebrata of the coast, went to show so much, followed by *Untersuchungen über Thierstaaten;* but even here, Vogt managed to intersperse political allusions in biological descriptions: an unnecessary feature, to speak the truth. His innate aggressiveness had again the best of him. A year or two passed, when he received from Geneva the proposal of a botanical chair. Vogt, not feeling qualified, declined. Well, would he accept a chair of Geology and Palæontology? Willingly: and now, at last, Vogt "settled." He became a Swiss citizen, and from 1856 to the day of his death, played a not unimportant *rôle* in Swiss politics, having been repeatedly elected to the highest councils of State. He was one of the founders of the *Institut National Genevois*, and while duly attending to his professorial duties, he took an active part in the more important political and scientific discussions or quarrels of the time. He was one of those who before the sixties, ardently advocated the creation of zoological marine stations; nor could he fail, when the "Origin of Species" was thrown on the world, to become an admirer and supporter of the new theory. The principal events of his life may now be rapidly noticed. In 1861, he travelled north and visited Norway, Jan Mayen, Iceland, publishing an account of his excursion in 1862 under the title "Nord-Fahrt entlang der Norwegischen küste," &c.; in 1863, were published "Vorlesungen uber den Menschen"—translated in English, French, Italian, Spanish, Russian, Polish, Hungarian—much read, much abused, but also much approved in spite—or because—of the burning ground which they covered; and the interest Vogt took there and then in prehistoric archæology was the cause of his investigations on anthropology, later embodied in different papers: "Ueber die fossilen Menschenschädel der Diluvialbildung," "La Machoire humaine de Naulette," "Le Crane du val d'Arno." His "Vorlesungen über schädliche und nützliche Thiere" were published at about the same time. In 1865–66 he issued his important "Mémoire sur les microcéphales ou Hommes-Singes," where he considered microcephaly as a return to the condition of man's ancestor—a view much opposed by Virchow, while no definite conclusion can be said to have yet obtained. From 1867 or 1869 he wrote little, but spoke much. At that time he travelled in Germany delivering lectures on the origin of man and the Darwinian theory. "Affenvogt"—monkey-Vogt, as he was nicknamed by the people, had occasionally a hard time of it. One evening, while he was lecturing, some stones crashed through the window. "I was talking yesterday evening, gentlemen," says Vogt, picking up one of the missiles, "I was talking of our savage ancestors of the Stone age: you may perceive now, that this age is not entirely a thing of the past." And Broca, writing to him about his book on useful and injurious animals, could rightly say: "Vogt, there are many beasts in this world and of the most injurious, of which you have said nothing." . . .

Vogt's life is so very full, that it is hard to even mention its principal phases. In 1872–74 we find him actively engaged in the task of creating a medical school—a university—in Geneva, and in 1875 he succeeds, having played a very prominent part therein; at the same time he publishes his "Atlas der Zoologie," translates Gegenbaur's "Manual of Comparative Anatomy"; writes papers for a number of reviews; works at Roscoff at his "Loxosoma" and "Recherches Cotières;" and has a good fight with anti-vivisectionists. In 1879, he comes forward again with a paper on "Archæopteryx"—the second skeleton discovered. In 1884, he publishes his large book on "Mammals," illustrated by Specht; and then sets to work at his "Traité d'Anatomie comparée," with E. Yung's co-operation. A large work, and one that entailed much effort—this treatise was completed only two years ago—it was Vogt's *chant du cygne*, the last work of a very complete and active life, and one which fittingly crowned and closed his career. Carl Vogt was spared the *ante-mortem* death which too often preys upon brain-workers, and kept his mental vigour to the end.

Ever liberal in spirit and in doings, he was to the last the champion of liberal measures and laws, and the protector of the oppressed. Scientific men may regret that he did not devote more time to pure science, but he has so much contributed to ventilate the *quæstiones vexatas* of his time, and to render them intelligible to the general public; he has so liberally devoted much of his time, activity, and talent to the furtherance of measures favourable to the benefit of all, that this regret must cease to exist. Doubtless, he was often excessive in language, and his undisguised materialism made him a large number of enemies. The latter cannot fail, however, to recognise the fact that the life of this "infidel" has been one of which no orthodox man could be ashamed, and that the guiding motives of Carl Vogt's thoughts, writings, and acts were generous and elevated.

M. William Vogt's account of his father's life is most interesting, and we have not been able to do it justice in so short an account. The son has inherited much of his father's wit and hot-headedness; he writes in picturesque and not over-academical style. Some letters of Vogt's correspondents are interspersed here and there: letters from von Baer, Bunsen, de Candolle, Darwin, Gaudry, Herzen, de Quatrefages, Sir John Lubbock, Lyell, &c.; but we much regret that there are not more of those of Carl Vogt himself. The large, powerful, lion-headed naturalist had not only power at his command; wit he had also, and he knew how to use it. The slender and piercing arrow he let fly as dexterously as he wielded the sword or the battle-axe. Many still live who could testify thereto.

HENRY DE VARIGNY.

THE EASTERN TIAN-SHAN.

Description of a Journey to Western China. By G. E. Grum Grzimailo, with the aid of M. E. Grum Grzimailo. Vol. I.: Along the Eastern Tian-Shan. With map and thirty engravings. Edited by the Russian Geographical Society. In Russian. 4to. pp. 320. (St. Petersburg, 1896.)

UNDER the above title the Russian Geographical Society has issued a new addition to its splendid series of works on Central Asia, which already contains the records of the journeys of Prjevalsky, Potanin, and Pyevtsoff. The yet so little-known mountains which are described under the vague name of Eastern Tian-shan, the great desert of the Hashuñ Gobi, and the Nan-shan highlands having been the field of exploration by the brothers Grum Grzimailo during the years 1889 and 1890, the present volume contains the records of the first year's journey along both slopes of the Tian-shan, in the oases of Guchen, Hami and Turfan. Starting from the Russian Turkestan town, Jarkent, the expedition went first to Kulja, whence they crossed the Eastern Tian-shan, named Boro-khoro in that portion of it. To do this, they went up the steep and 8500 feet high Tsiterty, or Achal Pass, from which most beautiful views open on Lake Ebi-nor, and where the chain falls most abruptly northwards to the sandy deserts surrounding the now rapidly desiccating lake, whose altitude is only 700 feet. Then the explorers made a series of unsuccessful attempts at recrossing the Boro-khoro Mountains from north to south. Although the Torgoutes, and next the Chinese, tried to dissuade them from such a venture, they went, nevertheless, up one of the tributaries of Lake Ebi-nor, but were soon compelled to return. In their middle courses, the streams which flow from the great chain run through remarkable cañons deeply cut in diluvial deposits, and in their upper courses the cañons become mere rents between high cliffs, through which the water, rapidly rising from the melted snow, rushes as a torrent. Compelled to return, the party explored the northern spurs of the Borokhoro, vainly looking for another pass, as they slowly moved east, towards the oases of Manas and Urumchi. From this last oasis they visited the beautiful group of the snow-clad holy mountains, Bogdo-ola, which raise their peaks above a picturesque alpine lake. One fully realises, on reading the travellers' description of these forest-clad mountains, covered with glaciers, and intersected with cool alpine valleys, while barren deserts surround them, why they are so much venerated by the Mongols and considered as the seat of deity.

From the next oasis, Guchen, the party made an incursion into the sandy Dzungarian desert, and there secured at last, with no little difficulty, two specimens of the Wild Horse (*Equus przewalskii*, Poljakoff), for which Prjevalsky had vainly hunted on his last journeys. The pages given to this hunt read like a novel—so difficult and exciting was the killing of two of these cautious animals, out of a herd of seven individuals who came at night to drink in a small salt lake, and whose security was most vigilantly watched by an old male.

The first specimen secured was about ten years old. The wild horse has something in common with the Altai, Caucasian, and Finnish ponies: it is of a short stature (1·46 metre high), and has a broad chest and back, a short, massive neck, and fine legs, as elegant as those of the racehorses, end.ng with broad hoofs. The head seems rather heavy in comparison to the body, but the wide forehead is handsome; the line from the forehead to the nose is straight, and the upper lip covers the lower lip. The tail, whose upper part has the colour of the body, while its point is black, is longer than the tail of the wild ass, but it is not entirely covered with hair. The mane begins in front of the ears, the longest hairs being in its middle part. In the scantiness of hair, the wild horse has also something in common with the Tekke Turcomane horse; but the killed specimen had a strange-looking pair of hard whiskers, about four centimetres long, running from the ears to the chin. The wild horse has a sandy colour in summer, and light brown in winter, with nearly white parts on the abdomen; the forehead and cheeks are darker than the remainder of the body, while the end of the snout is whitish. The legs and the mane (which hangs to the left) are black; the spinal mark hardly exists, and disappears in winter. As a rule the hair is short and glossy, but somewhat curly in the foals. A good photograph of the killed horse, in profile, is given by M. Grum Grzimailo.

The manners of life of the wild horse differ from those of the wild asses—the *djighetais* and the *kulans*. They stay, in preference, in the deserts, while the latter prefer the mountain regions. They march in Indian file when they feel danger, and leave in the desert their traces in the shape of well-marked paths, as they march from their retired abodes amidst the desert hillocks to their drinking-places. They neigh exactly as our horses, while the wild asses only bray, and they have the characteristic growling of our horses. The Mongols sometimes succeed in catching young foals, but they never could tame them.

From Guchen the expedition went to Hami and Turfan, the most important centre of the region, and the work under review contains very valuable data relative to the inhabitants of these two oases. From Turfan they moved southwards, exploring the Bei-shan mountains, and coming to several interesting conclusions concerning the relations between the Tian-shan and the southern highlands, which relations will be treated more fully in the next volume. In the south of Turfan they made the remarkable discovery of the Assa depression, near Lukchun, where the barometer stood so high that, on comparing its heights with the isobars for the corresponding days in other parts of Central Asia, General Tillo concluded that the level of this depression is about 170 feet *below* the level of the ocean. The two years' barometrical observations, subsequently made by one of the members of Roborovsky's expedition, have fully confirmed the above conclusion.

A map of the region, on a scale of twenty-seven miles to the inch, accompanies the work; and certain photographs—namely, of the Bogdo-ola lake and mountains, the wild horse, and the inhabitants of the oases—are very interesting. A list of the birds brought in by the expedition, which were described by F. D. Pleske in the *Mélanges Biologiques* of the St. Petersburg Academy of Sciences (vol. xiii.), as well as a list of the Lepidopteræ collected by the author, complete the volume. Other valuable collections are still in the hands of specialists.

P. K.

OUR BOOK SHELF.

Navigation and Nautical Astronomy. By F. C. Stebbing, Chaplain and Naval Instructor, Royal Navy. Pp. vii + 328. (London: Macmillan and Co., Ltd., 1896.)

MR. STEBBING'S "Navigation and Nautical Astronomy" is the most satisfactory treatise on the subject we have yet seen. The author's experience, as a man of university attainments, a naval instructor afloat, and Admiralty examiner at Greenwich, has enabled him to produce a book that meets the practical and theoretical requirements of the modern navigator without being overladen with perplexing disquisitions or elaborate and unnecessary formulæ.

The works we have hitherto come across generally run into one extreme or the other. The first group, of which we may take Raper's as a type, consists of excellent practical examples and methods, but is so deficient in explanation and theory that a student could not obtain any grasp of the principles involved without the assistance of some friendly tutor. This is a serious objection if we consider the need of amended methods to meet the present increased speed of ocean transit and the consequent emergencies.

The other group, following on French lines, is so lumbered with investigations of a high mathematical order as to be quite beyond the comprehension of the average sailor.

Jean, who made an attempt to combine the two, produced two volumes of good matter, but ill-arranged and cumbersome. He has, in addition to the versine method, five difficult and different ways of "clearing the lunar distance."

We are glad to see that Mr. Stebbing has taken to heart the fable of the cat and the fox, and in every astronomical problem has selected the method in general use among the advanced school, and has explained and solved his problem by that method, and that only. His book is therefore of modest dimensions, and any student of average intelligence can read it and comprehend it unaided.

The comparatively small number of first-class navigating officers is in itself a conclusive proof that the art of navigation is much more intricate than a casual run through the subject would lead us to suppose. Long experience and special advantages are necessary to graduate as an instructor in this branch of science, and we therefore all the more welcome Mr. Stebbing, who happens to possess these special requirements, as a guide to our sailors of the present and the future.

The Distribution of Rain over the British Isles during the Year 1895. Compiled by G. J. Symons, F.R.S., and H. Sowerby Wallis. Pp. 237. (London: Edward Stanford, 1896.)

MR. SYMONS'S staff of voluntary observers now numbers 3084, having grown from 168 in the year 1860. Of these observers, 2304 have their stations in England, and only 398 in Scotland—a disproportion which is to be regretted. The large number of private stations where good records of rainfall are kept, is a striking testimony to the interest taken in local meteorology.

The present report contains an interesting article on Seathwaite as a rainfall station. The first systematic records of the rainfall at that place were made in 1845, so the station attained its jubilee in 1894. The following conclusions concerning this very wet spot are stated by Mr. Symons: (1) The rainfall at Seathwaite is on the average 135 inches a year. (2) In the wettest year it has exceeded 182 inches, and may possibly reach 190 inches. (3) In the driest year it has fallen to 88 inches, and will probably never be less. (4) In one month (November 1861) more than 35 inches fell. (5) In September 1894, very little more than half an inch fell. (6) There are nine recorded cases of more than six inches falling on one day—probably there have been about a dozen—the heaviest recorded was 7·52 inches on November 26, 1861.

Several plates illustrating Seathwaite, and the positions and patterns of the rain gauges, accompany the article.

In another article in the present volume systematic percolation experiments carried on at Apsley Mills, Hemel Hempstead, are described and discussed. Gauges were sunk in sand, chalk and earth, to measure the percolation at depths of 3 feet and 5 feet in each case. The result of the whole of the observations is, with a probable error of less than 2 per cent., "that with a rainfall of 26 inches, 16 inches percolate through 5 feet of sand, and 10 inches are evaporated from it; and that 12 inches soak through 5 feet of chalk or earth, and the other 14 inches either evaporate or run off the surface." The differences between the results obtained by the gauges at 3 feet and 5 feet were very small. The loss by evaporation is found by Mr. Symons to follow very nearly the same monthly variation as that from a water surface, but is decidedly less.

There are several other articles on various branches of rainfall work, and they help to make the new issue of "British Rainfall" an interesting volume.

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 intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Total Solar Eclipse of August 9, 1896, as observed in a Cloudless Sky at Bodö.

As Bodö was considered as offering conditions not favourable for serious work, this pretty town, so easily accessible for the greater number of European astronomers, was left unprovided with any astronomical instrument. And yet that town was, during the eclipse, favoured by a cloudless sky, which could have given magnificent results. I had the good fortune to observe there the wonderful phenomenon, and to make (what was chiefly my purpose) a sketch of the general outline and the rays of the corona. I do not think that among the thousands of Norwegians who witnessed that grand spectacle there were more than twenty foreigners, almost all English and American ladies and gentlemen.

The place we selected was on a hill at Brevig on the Saltenfjord, near Bodö, which hill had been found on May 3, when the sun was as high as on August 9, to be well situated for the eclipse observation. The weather on the previous days had been fine and very promising, and on the night of August 9 was even more splendid than before. On seeing the sun rise wholly clear from behind the mountains, no trace of the smallest cloud spoiling the clearness of the sky, an enthusiastic "hurrah!" arose from the numerous gathering on the hill.

Two minutes past 4 o'clock we first saw that the sun's edge, in the northern hemisphere and on the right-hand side, was hidden by the moon. Little by little the sun's disc was covered more and more, but the amount of light did not sensibly diminish until more than three-fourths of the disc were obscured. The darkness gradually increased, for the moment of the total eclipse was approaching. How slowly the seconds seemed now to pass, and how quickly after the first moment of totality! That impressive moment occurred at 4.54. Then at once we saw the moon of almost inky darkness encircled by the white corona. The corona was not at all regular. Its most peculiar feature was the total absence of any ray or streamer in the vicinity ($\pm 25^\circ$ W. and E.) of the sun's North Pole. Over the South Pole the corona was also a little less extensive than in the middle latitudes, where the greatest accumulations were to be seen in two enormous wings on both sides of the dark, empty space over the North Pole. The only colour I observed was the pink colour of the chromosphere around the edge of the moon (and less, also, at the sun's North Pole). In the chromosphere a few points (especially one at the left-hand, a little south from the equator) were blazing with dazzling brightness. Although the sudden apparition of Jupiter, Venus and Mercury, and, according to some observers, also of a star in the constellation Gemini, was very impressive, the darkness was not so great as I had expected, and did not hinder me in the least in beginning the sketch, which—not for want of light, but for want of the necessary calm of mind—I could only finish when all totality was over. The moments were too short and precious. I looked also an instant at the water in the fjord, and the snow-mountains on my left hand. The fjord was dull grey, the mountains pink at the bottom, and more yellowish at the top. The grass on our hill was dark olive-green.

At 4.55½ the sudden blazing up of a white point, quickly growing to a crescent at the right-hand side of the sun, proved that totality was over. At the first glimpse of sunlight, corona, chromosphere, and planets ceased to be visible to me.

Till 5.50 the sun remained partially eclipsed. Thus we observed the sun on our steamer *Ofoden*, while returning to Bodö. But who could imagine our surprise, and the increase in our gratitude for the splendid conditions in which we had seen the eclipse, when, twenty minutes after totality was over, we saw the sky everywhere, and especially also at the sun's side, covered with heavy clouds! It was as if these clouds had been caused by some cooling effect of the eclipse. A. BRESTER, JR.

Delft, Holland, August 23.

Air Temperature during the Solar Eclipse.

SOME observations of air temperature, which I was able to make at Vadsö during the solar eclipse on August 9, are perhaps worthy of being put on record. I observed on the plateau or flat-topped hill north of the town of Vadsö, a few minutes' walk beyond Prof. Copeland's station, and at the height of 400 feet above the sea, by aneroid. None of the astronomical observers occupied quite such a high position. It was chosen in order to escape the disturbing effect of air-currents on the hill-side sloping to the fjord. The thermometer was provided with a small bulb, and hung from the tripod of a 3-inch telescope, the bulb being about 18 inches from the ground. No special precautions were taken to shield it from the sun's rays; unfortunately, they were not necessary. A light northerly breeze was blowing, and the sky was heavily clouded.

Speaking roughly, the eclipse began at 4, was total at 5, and was over by 6 o'clock. At 4.8 and at 4.18 the temperature was 44·0° F.; at 4.23, it was 43·5°; at 4.28 and 4.33, 43·2°. From 4.35 to 4.43 the sun was shining brightly, and the temperature rose to 43·3°; at 4.53 and 4.59, glimpses of the sun were caught before and after totality. The temperature from 4.48 to 4.58 was steady at 43·0°; at 5.0, it had dropped to 42·1°; from 5.3 to 5.13 it stood at 42·3°. By 5.33 it had risen to 43·8°, and at 5.48, when I ceased observing, to 45·0°.

The suddenness of the fall at, or rather immediately after, totality is very marked, the depression amounting altogether to 1·9° F. from the commencement of the eclipse, and the subsequent rise being equal to 2·9° F. to the end of the eclipse.

1 Savile Row, W., August 24. HUGH ROBERT MILL.

The Position of Science at Oxford.

YOUR correspondent "W. E. P." shows a curious ability for injuring his own side. He says that "Oxford collectively has done her best to remove any inferiority she may have had in the past" in respect of her scientific school, and further, "it would be difficult to name a body better qualified to decide what is a good general education than Convocation itself." And yet the whole tone of his letter is a practical confession that Oxford has failed in her best attempt, and that her view of general education has resulted in a practical failure to forward an essential branch of general education. The fact is Oxford's best is bad, and her ideal education is one-sided. The most serious cause of complaint of modern society against the old universities is that they have so controlled the education of the wealthy classes of the community that the landed and professional classes have been educated apart from the commercial and industrial classes to the very great injury of both. One might as well consult a committee of clergy as to the best education for a doctor, as advise with university dons as to the best education for the general community. The influence of a Pagan civilisation has created in them an ideal of life founded on contemplative learning, rather than on a Christian benevolent activity.

GEO. FRAS. FITZGERALD.

Trinity College, Dublin, August 19.

On the Notation of Terrestrial Magnetic Quantities.

AT the International Meteorological Congress to be held in Paris, a number of questions of special interest to magneticians have been proposed for discussion, among which is the following:—"The same notation should be generally employed, *H* for horizontal force, *X* for the northern component, *Y* for the western component, *Z* for the vertical force, and *V* for the potential." As the need of some uniform notation has been made apparent to me in connection with the journal *Terrestrial Magnetism*, I have been paying this matter some attention with the view of obtaining a concise and logical system for adoption in that journal.

The principle upon which I proceed is to take the first letter of a word designating a particular quantity, if at the same time it conforms with typographic requirements, such, for example, as declination, which is common to several languages. In this way I have thus far obtained the following: *D* for declination, *I* for inclination, *H* for horizontal component of force, *V* for vertical component, *F* for total force. Upon examination it will be found that these letters stand for words derived, in almost all cases, originally from the Latin and Greek languages, and with but insignificant variations in spelling, common to several of the main modern languages.

The Germans will be asked to yield a point with regard to *F*,[1] but this, as will be seen below, will be made up to them in the adoption of *G* for magnetic potential. *V* taken from the Latin *vis*, or *I* from *intensitas*, or *D* from the Greek word δύναμις, would not do for force, as they are already taken. Nor would *T* from *totus* or *P* from πᾶς answer, since the former is frequently used for time of vibration, and so in fact is the letter *P*, which stands besides for the first deflection coefficient. As I hope to be able to find a satisfactory notation for all the principal magnetic quantities, I am keeping this matter constantly in mind in adopting any particular letter. The English and French have *force*, and I have, therefore, adopted *F* for total force. As it is frequently the custom to designate angular quantities by Greek letters, I should have preferred, had it been possible, to adopt δ and ι instead of *D* and *I*, but the Greek ι is a very unsatisfactory letter from a typographical standpoint. Moreover, if found desirable later on, the small letters *d* and *i* or δ and ι can be reserved for the variations on the mean of day and on the mean of year respectively.

I think it very much to be deplored if *Z*, as above proposed, be universally adopted to designate the vertical force. It should not be forgotten that the Gaussian mode of resolving the magnetic force into northerly component (*X*), westerly component (*Y*), and vertical component (*Z*), applies to a *local* system of coordinates, not to a *fixed* system, as the layman might naturally suppose—a fact which is even apparently forgotten at times by magneticians. The mean values of these components for a complete circuit of the earth along a parallel of latitude can, in consequence, no more be *physically* interpreted than the mean *H*, for example. I am, therefore, opposed to adopting for the vertical force a letter which in no way gives evidence of the exact quantity for which it stands. *V*, on the other hand, is logically connected with *H*, and at the same time implies that the direction of the quantity that it symbolises is *local*, the direction of the vertical or plumb-line varying from point to point.

For the same reasons I am not in favour of adopting *X* for northerly component, and *Y* for westerly component. Let authors choose this method of notation, if they prefer it; but in a system suggested for universal adoption, it would seem to me that *N* and *W* would more satisfactorily meet the requirements, clearly indicating to the eye as they do the local character of the system of coordinates employed.

As a letter to designate the earth's magnetic potential, I believe none more fitting could be adopted than *G*, after Gauss, the author of this function. Gauss himself used *V*, but this letter is not sufficiently characteristic; it is used to designate many other functions in mathematical physics; and there would, moreover, be a conflict in our system, since *V* seems the most logical letter to designate the vertical force. L. A. BAUER.

Linden, Montgomery County, Maryland, August 10.

[1] The initial letter of the German word *Kraft* is frequently used to designate the moment of inertia, and hence will not answer for force.

On "Hullite."

THE authors of a paper just published in the *Transactions* of the Royal Irish Academy, which is certain to be widely read, have dealt at length with the material called "hullite," urging that it is, in reality, "a hydrous glass of low specific gravity."

This paper was read on June 10, 1895, but a "note added in press" concludes as follows:—

"An abstract of this paper was published in NATURE of June 27, 1895; since then I have received, by the kindness of Prof. Cole, a paper by him on 'hullite' [reference given, *Proc. Belfast Nat. Field Club*, 1894–5, p. 1]. It contains an interesting *résumé* of the literature of the subject, and describes, quite independently, the occurrence of 'hullite' as 'a true ground-work to the crystalline constituents' of the rock in which it occurs."

I should not have referred to the matter had not the date of publication in NATURE been quoted in a way that suggests a sort of challenge. It seems only fair to point out that my paper was read on March 19, 1895, and that the conclusion—that the material was "an altered basic glass"—was published in two places in the *Irish Naturalist* on May 1, 1895. The full paper appeared on July 1, 1895. The two investigations, to some extent supplementing one another, afford certainly a curious case of parallelism. GRENVILLE A. J. COLE.

Royal College of Science for Ireland, August 20.

Foreign Snails in the West Indies.

Two large living specimens of *Stenogyra* (*Rumina*) *decollata*, Linn., were recently found in the garden of Dr. W. J. Branch in St. Kitts. Though familiar with the land shells of the island, having lived and collected there for many years, Dr. Branch had never come across this shell before.

These had probably been introduced accidentally as young or eggs among European plants. Tryon states that the snail is naturalised in Charleston, South Carolina. It seems to have thrived in our garden, which is very tropical, but we cannot say yet that it is naturalised.

We have tried the introduction of foreign snails into this island. *Helix* (*Dentellaria*) *josephinæ*, Fér., from Barbados, did well in a garden, but since we changed our residence it seems to have disappeared. *Bulimus* (*Borus*) *oblongus*, Mull., introduced a few years ago, also from Barbados, thrives and multiplies, but has not, so far, gone beyond the garden. It would seem, then, that the chances are against the *Stenogyra* becoming fixed in St. Kitts. The fact of its chance occurrence is, however, worth recording. C. W. BRANCH.

St. Kitts, W.I., August 2.

THE ARCTIC RECORD OF 1896.

THE triumphal progress of Dr. Nansen and his companion, Lieut. Johansen, along the coast of Norway has been interrupted by the most striking coincidence ever known in Arctic travel—the appearance of his ship the *Fram*, with all her crew in good health, and with a record of northern latitude only less remarkable than that attained by Nansen himself. On the very day that Nansen sighted the coast of Norway, the *Fram* forced her way out of the ice-pack into the open sea.

It will be remembered that Dr. Nansen's expedition was based on a theory of polar ocean-currents. The map published in NATURE for May 17, 1894 (vol. l. p. 57) shows that a current or drift was supposed to set across the Arctic Sea from the neighbourhood of the New Siberian Islands to the coast of Greenland, passing within a few degrees of the North Pole. The strongest piece of evidence for the existence of such a current was the discovery off Julianehaab, in south-west Greenland, of certain relics believed to have drifted from the *Jeannette* after her loss near the New Siberian Islands. The authenticity of the *Jeannette* relics is still in dispute. A very elaborate criticism of the evidence concerning them was published, by Prof. W. H. Dall, in the *National Geographic Magazine* for 1896 (vol. vii. p. 93), which concluded with the opinion that the whole affair was a hoax. This was warmly contradicted by a powerful Committee of the Geographical Society of the Pacific, which wound up its report on May 9, 1896, with the words: "After carefully weighing these statements and recalling the mental and physical characteristics of Dr. Nansen and the brave comrades and men who cheerfully accompany him, and the special fitness of the *Fram* to encounter ice dangers, the Committee places upon record its convictions—that the present expedition was fully warranted, and that it will return successful." A month ago these arguments were the only data on which to found an opinion as to Nansen's fate; and I was astonished to find how pessimistic were the views entertained by well-informed Norwegians, some of whom laughed heartily at me off the Nordkyn on August 10 for turning my glass on the northern horizon on the chance of sighting the *Fram*, which they believed to have been long ago crushed in the ice, and her crew perished. The unfavourable views expressed by our leading Arctic authorities on Dr. Nansen's scheme of pushing his ship into the ice and allowing her to drift with it, and on his plan of building his vessel so that she should be forced out of the ice instead of being crushed by it in case of being nipped, were loudly expressed, but they are also, fortunately fallacious. The new scheme, founded on a carefully considered hypothesis, has proved completely successful, in spite of its opposition to all the maxims of polar experience and the demands of traditional prudence.

NATURE published last week the very full telegraphic data, obtained by the *Daily Chronicle*, as to the main points of this most successful of all polar expeditions. These should suffice to satisfy public curiosity until the intrepid explorer is able to give a personal account of his work. The fact that the pole was not reached is unimportant, for it is conclusively proved that the pole may be reached with comparative ease by good ski runners, aided by a sufficiency of dogs. The additional news brought by the *Fram*, throws a good deal of new light on Arctic geography. As reported in the *Daily Chronicle's* telegram from Skjervö on August 21 and 25, the general course of the vessel was exactly that predicted by Nansen when he quitted her, viz. westward round the north of Franz Josef Land. She was left under the command of Captain Sverdrup on March 14, 1895, in 83° 59′ N., 102° 27′ E., embedded in the drifting ice about 450 miles north of Cape Chelyuskin, and 400 miles east of Franz Josef Land. By the end of February 1896, she had reached 84° 9′ N. and 15° E., a drift of 600 miles, which brought her to a point about 280 miles north of Spitzbergen. Parry in 1827 had reached 82° 45′ on the same meridian by sledging over the floe until he was stopped by the rapid southerly drift of the ice. While north of Franz Josef Land the *Fram* reached its highest latitude, 85° 57′, only about 20 miles short of that attained on Dr. Nansen's sledge journey, viz. 86° 14′. Had it been possible to dispatch a sledge party from this point, the pole would most probably have been attained. From July 19 to August 12 the *Fram* was working her way out of the ice by her steam power; then gaining open water, she reached Skjervö on August 21. The minimum temperature observed was −52° C., the maximum only 3° C. Neither land nor icebergs were seen, only an expanse of hummocky floe ice unbroken by any considerable stretches of open water. The ice grew to about 13 feet in thickness, and the sea ranged in depth from 1800 to 2200 fathoms.

Sir George Baden-Powell was fortunate enough to receive Dr. and Mrs. Nansen on his yacht the *Otaria* at Hammerfest, and to have the satisfaction of taking them to meet the *Fram*, with which they will probably proceed to Christiania. The enthusiasm of the Norwegian people over Dr. Nansen's success and safe return was beginning to be touched with anxiety for the fate of his equally courageous companions, which this happy reunion has effectually banished.

Until the voluminous observations bearing on almost all branches of science have been fully discussed, the true value of the results of the expedition cannot of course be known. Even now, however, some important facts are plain. Franz Josef Land is only a group of islands possibly smaller than Spitzbergen, and it does not afford the dry land highway to the pole to which at one time it was hoped to be the doorway. The absence of icebergs practically proves the absence of any extensive land in the track of the current, although it may be that the drift of the *Fram* being towards the east and not the west of Greenland, indicates the existence of a land barrier near the pole, or on the American side of it. The dream of an open polar sea must be abandoned for ever. One of the most interesting results so far announced is the great depth of the Arctic Sea over a very large area. This accentuates the physical contrast between the Arctic and the Antarctic regions; and will probably make it necessary to adopt a greater mean depth for the ocean, and a deeper position for the line of mean-sphere level (*cf.* NATURE, vol. liv. p. 112). The general course of the *Fram*, as sketched from the provisional data, shows an altogether remarkable parallelism with Dr. Nansen's hypothetical track of the *Jeannette* relics, and fully bears out his theory of the circulation of the Arctic Sea. A "palæocrystic sea" would appear to be possible only in conditions which give rise to eddies, or otherwise impede the normal circulation. The temperature has not been found so low as that frequently experienced in northern Siberia, so that unendurable cold can no longer be viewed as an obstacle in the way of making high latitudes.

So far as high latitudes go, Admiral Markham, in 1874, succeeded in passing Parry's position of 1827 by only 35′, or about forty miles; Lockwood, in 1882, did not get more than four miles further north than Markham; but Nansen has taken the unexampled stride of 2° 50′, or almost two hundred miles beyond the previous "record," in consequence of his simple plan of not opposing, but siding with the workings of nature. The result is a triumph of science, and a proof—if proof were needed—that scientific training, no less than courage, perseverance, and physical endurance, is necessary in a great explorer.

Apart from the voyage of the *Fram*, this summer has yielded a rich harvest of arctic exploration. The *Windward*, which left Vardö on June 29, under the command of Captain Brown, an experienced whaler, and with the aid of Mr. Crowther as ice-master, has made a remarkably quick voyage to and from Franz Josef Land. She took out Mr. W. S. Bruce and another member of Mr. Jackson's party, and brought back several whose time with the expedition had expired. The telegrams which have been received show that Mr. Jackson's party have passed the winter comfortably, and have had excellent sport; they have devoted themselves to the mapping of the region around their winter quarters, and dispatches are promised by the *Windward*, which will doubtless give particulars as to points visited and positions attained. Dr. Nansen's journey on the ice north of Franz Josef Land will be a powerful stimulus which should result in great achievements.

Mr. Andrée's balloon expedition has had to be postponed on account of delay in getting the balloon-house erected and the balloon filled, but it will certainly be renewed next year. Spitzbergen, with weekly mail-steamers, a comfortable hotel, and even a set of postage-stamps, has been largely visited by tourists during the summer; but amongst the sight-seers and sportsmen there have been several scientific men bent on serious exploration. Sir Martin Conway, with Dr. Gregory, Mr. Garwood, and Mr. Trevor Battye, have been over a large amount of new ground, and made several interesting discoveries. The geology of the islands in particular has been carefully worked up, and the results will be looked forward to with confidence. The whole party has safely returned to Norway.

Mr. Peary's expedition to the north-west coast of Greenland has been much hampered by the ice, and it is uncertain whether it will yield any scientific results. The application of the name *Peary-land* to the extreme north of Greenland, proposed by the Geographical Club of Philadelphia, has been generally approved as a tribute due to an explorer of great power and perseverance.

Prospects of Antarctic exploration are no brighter. The Belgian expedition has been postponed, and the English expedition to Cape Adare does not seem likely to start this year. There is, however, a possibility that the wave of enthusiasm in polar research, which is sure to pass over Europe during the coming winter, may float some of the existing schemes, or even move high quarters, and lead to the dispatch of a properly equipped Government expedition. However glad we should be to see a British party regaining the national prestige in the polar regions, the need for scientific research in those quarters would lead us to welcome the first who comes forward with a sane plan and a sound party, be their nationality what it may. The drift of the *Fram* has shown that the new explorer may succeed, even though he may contravene every law laid down by the old, provided he respects the law of nature of moving in the direction of least resistance, and not trying to hurry through in a season what should be the deliberate progress of years. May it not be possible that we have somewhat over-estimated the necessity for naval discipline, and under-valued the power of scientific enthusiasm in polar exploration? HUGH ROBERT MILL.

SIR WILLIAM ROBERT GROVE.

"I HAVE long held an opinion almost amounting to conviction, in common I believe with many other lovers of natural knowledge, that the various forms under which the forces of matter are made manifest have one common origin; or in other words are so directly related and mutually dependent that they are convertible, as it were, into one another, and possess equivalents of power in their action. In modern times the proofs of their convertibility have been accumulated to a very considerable extent, and a commencement made of the determination of their equivalent forces."

Thus wrote Faraday in 1845, beginning his paper "On the Magnetization of a Ray of Light and the Illumination of Magnetic Lines of Force," and the words describe admirably the subject of William Grove's great work "On the Correlation of the Physical Forces" which appeared in the following year. But as a matter of fact this famous essay had been brought into existence three years before as a course of lectures delivered at the London Institution, in which Grove then held the post of Professor of Experimental Philosophy. It was the first systematic statement of the connections between the different departments of physical phenomena, and as such was of great scientific (that is *science-making*) value. Helmholtz's magnificent exposition of the principle of conservation of energy appeared the year after, and contained as completely as was then possible that quantitative discussion referred to in the last words of the above quotation from Faraday, as being when they were written, at various points begun. These two remarkable essays may be said to form the starting-point of the modern science of energetics, of which the experimental foundation was even then being overhauled and laid still more deeply and stably by Joule. If we reflect how much has come from the principle of constancy of energy with the necessary aid of other dynamical principles (for the theory of conservation is by itself insufficient for the determination of the mode of action of physical forces), we are better able to form an idea of the value of the work done by these pioneers in exploring and mapping out the paths which appeared to lead from one province of science to another.

At the time of the publication of his essay Grove was about thirty-five years of age, having been born at Swansea in 1811. He had already accomplished a considerable amount of original work of great value. His voltaic cell, known now to all who have even the slightest knowledge of electricity, was one of several voltaic combinations which he devised, and was described first at the British Association meeting at Birmingham in 1839, and again in a paper in the *Philosophical Magazine* for October of the same year. Though the Grove battery is now superseded in most of our laboratories by dynamos, it was in its day a discovery of no slight scientific importance. It solved in a very satisfactory way for practical purposes of experimenting the problem of how to obtain a voltaic battery of high electromotive force and moderate resistance, free from the paralysing effects of polarization when used to generate large currents for fairly long intervals of time. The battery soon became a great favourite for experiments involving heavy currents, such as the production of the electric light by means of an arc between carbon points; and it was that used by Faraday in his electro-optic experiments.

From the age of twenty-five to fifty Mr. Grove, though pursuing the profession of the Law, was actively engaged in scientific work, and at a comparatively early age was elected a Fellow of the Royal Society. Just fifty years ago he was awarded a Royal medal for his paper "On Certain Phenomena of Voltaic Ignition and the Decomposition of Water into its Constituent Gases by Heat," which formed the Bakerian Lecture for 1846. His papers are numerous and deal mainly with the phenomena of the voltaic cell, and of electrolytic decomposition generally. The subject of the polarization of gases in particular occupied much of his attention, and he discovered the well-known gas-cell, so interesting from a theoretical point of view, and especially now as being the forerunner of the modern secondary battery. Besides these Mr. Grove studied electrical discharge, the effect of light on polarised electrodes, and other subjects which, investigated with the aid of modern appliances and instruments, have yielded a rich harvest of valuable results.

The most active part of Mr. Grove's scientific career may be said to have ended about the time of his presidency of the British Association at the Nottingham meeting in 1866. His presidential address was on his favourite subject "The Continuity of Natural Phenomena," and he had then the satisfaction of finding the views he so early held now shared by all scientific workers, and illustrated by a great mass of recent scientific discovery. In 1871 he was made a Judge, and shortly afterwards received the dignity of knighthood. In 1875 the honorary degree of D.C.L. was conferred on him by the University of Oxford, and was followed in 1879 by that of LL.D. from the University of Cambridge. For sixteen years he devoted himself unremittingly to his legal duties, but in 1887, when he retired from the Bench, his former scientific interests and activity, never extinct by any means, in great measure returned. But at his now very advanced age arduous scientific work was impossible, and his contributions to scientific literature were limited to such lectures and addresses as his strength enabled him to deliver.

In the preface of his essay on the Correlation of Physical Forces, Sir Wiliam Grove represented himself as standing on the vantage ground obtained by the labours of others, and therefore as able perhaps to see somewhat further than those who had gone before. It is ever thus: the men of to-day work more surely and swiftly because such men as he have lived and worked before them. It has been given to few to witness, as did Sir William Grove, almost all the scientific progress of the nineteenth century, and it must have well rewarded his scientific spirit to see the younger generation enter into the labours of the founders of the theory of energy with so much eagerness and so great a promise of fruitful achievement.

A. GRAY.

PROFESSOR HUBERT A. NEWTON.

AT the time when the attention of astronomers is again directed to the return of the nucleus of the November meteors, the sad intelligence reaches us of the death of Prof. Newton, of Yale College, whose reputation is largely connected with the history of this shower, and who, perhaps more than any other, has advanced the position of meteoric astronomy to that it now holds. He thus rendered a great service to astronomy, and had he no other claims to remembrance this would ensure a grateful recollection. Prior to his historical researches the observation of meteors possessed but a languid and feeble interest, lacking that coherence and purpose which method, founded on a suggestive hypothesis, alone can give. The collection and discussion of the original accounts of thirteen meteoric displays, all of a similar description, and distributed over a period of more than nine hundred years, demonstrated the permanent character of the phenomenon, rendered prediction possible, and invited hopeful inquiry. The fact that he left the inquiry incomplete scarcely diminishes the extent of his service, since he showed that the problem came within the range of celestial dynamics, and he at once indicated the method and supplied the means which it was certain would be effective in the hands of a master of profound and subtle analysis. It is not necessary to pursue the subject further, or to more than mention the interest subsequently added to meteoric inquiry by the discovery of Schiaparelli and others working in this fruitful field; the impulse had been given, and the subject of shooting-stars became vividly and permanently a subject of astronomical notice.

Prof. Newton's connection with the observatory of Yale University has been long and honourable. Perhaps one is not quite justified in calling him the Director of the Yale Observatory, but his position seems rather difficult to define as the Secretary to the Board of Managers, who annually present a report to the President and Fellows of Yale College. For two years, 1882–4, he certainly held the position of Director; but he seems to have preferred his old position of Secretary, leaving the head of each department to make a separate report. There can be no doubt, however, but that his was the directing mind, and determined the character of the observatory. It was while he held the position of titular chief that the heliometer, which in the trained hands of Dr. Elkin has proved itself of such value, was mounted, and probably it was his suggestion that the observatory should possess an instrument of exact measurement rather than one of those gigantic equatorials, which elsewhere in America have appealed to the fancy, and satisfied the ambition of the millionaire. Certainly he subscribed liberally to the guarantee fund which ensured its use by a skilled astronomer, and the work that has issued from the observatory under his management, whether it be parallactic inquiry or stellar triangulation, has amply justified the expenditure, and placed the institution in the front rank of those devoted to extra-meridianal work. Not but that the utilitarian side of astronomy has also been ardently pursued at Yale. The distribution of time signals, the testing of chronometers and philosophic apparatus have long been a part of the routine work, and the observatory has worthily striven to maintain a high standard of workmanship.

Prof. Newton's services to science are by no means exhausted by the fulfilment of the duties of his chair or of the direction of the observatory. He has held the post of President of the American Association for the Advancement of Science, and been the author of many papers, generally connected with meteoric or cometary astronomy. More particularly may be mentioned his inquiry into the capture of comets by Jupiter or other planets, in which he has shown that the perturbing action of the planets on parabolic orbits of every possible inclination to the ecliptic tends to produce elliptic orbits of short period, moderately inclined to the ecliptic and with direct motion.

The Royal Society recognised the eminent services Prof. Newton had rendered to astronomy by placing his name on the roll of foreign members in 1892.

W. E. P

THE ECLIPSE OF THE SUN.

KIÖ ISLAND, BRAS HAVN,
Thursday, August 6, 1896.

BEFORE I attempt to give an account of what we have done here and of the local conditions generally, it may be well to state what, in my opinion at all events, is the most important work to be done at eclipses in the present state of our knowledge.

In looking back along the eclipse records, say till 1870, it is not a little surprising to note how the attack has varied in the importance attributed to certain of the inquiries; and how often it has happened that the chief scientific result secured at any eclipse was hardly dreamt of by the organisers of the expeditions. But when there has been this notable divergence between anticipation and actual result, the work done has proved of the greatest advantage to science. I shall not be sorry, therefore, if the following anticipations fail to include the most important advances made during the coming eclipse.

In the first place I think the records already obtained by large scale prismatic cameras have shown to everybody that these instruments are the most important ones we can employ on an eclipsed sun. They not only give us a complete chemical record, on a scale hitherto undreamt of, but they give us the positions and forms of the prominences far better than they have ever been obtained before. Nor is this all, they enable us to study under new conditions some of the conclusions arrived at in previous eclipses, and give us a means of inquiring into the possible origins of some of the phenomena already recorded by slit spectroscopes.

It is now more than a quarter of a century since bright lines were recorded in the spectrum of the dark moon. There could, of course, never have been any doubt that this was due to chromospheric glare in our atmosphere; but the moment this was conceded, the more difficult it became to determine the exact height of the solar envelopes, for if there was glare over the dark moon, how high might it not extend over the prominences?

Now one of the important points about the prismatic camera is that it is quite impossible for it to treat such a general glare as this in the same way it does any local illumination; as a result of this property any effect due to general glare which *can* be recorded by a slit spectroscope *cannot* be recorded by the prismatic camera, and so, roughly speaking, a comparison of the two records may be safely trusted to eliminate the effects of such glare.

It will be generally recognised that this is an important service to render; but there is another which, from the chemical point of view, is more important still—it enables us to localise the origins of the various radiations which build up the spectrum of the sun's surroundings, whether they be high or low.

For the first time in 1893 the corona was photographed as a ring by means of the prismatic camera in "1474" light, and apparently associated with it were other rings in the ultra-violet. The 1474 ring was best shown in the Brazilian photographs taken by Mr. Shackleton, but the others in the series taken by Mr. Fowler in West Africa. Now we find that the brightness of these coronal rings seems to depend upon proximity to the equator, and is entirely independent of the prominences. That the true spectrum of the corona will be eventually thus discerned is unquestioned, and the sooner it is done the better. This part of the attack this year has been greatly strengthened, and not only have we here prismatic cameras of 6 and 9 inches aperture, but I have equipped Mr. Shackleton with a powerful instrument for his observations in Novaya Zemlya, whither he has gone in the expedition rendered possible by the public spirit of Sir George Baden-Powell.

The large scale prismatic camera was, as I have said, introduced in 1893—that is, only three years ago. The results obtained in that year represent, therefore, only the experimental stage; at the critical moments of the eclipse—that is, at the beginning and end of totality—only snap-shots were taken. This time what is termed a dropping-plate is introduced in the programme of the 9-inch. That will be exposed, while gradually falling, from ten seconds before the end of totality to fifteen seconds after, in the hopes of catching the so-called "flash" which is supposed to represent the "reversing layer." To my mind, the reversing layer is dead and buried already, but may the fates be propitious on the 9th, and enable us to place a wreath on its tomb.

So much then, briefly, for the prismatic cameras and the pre-eminent importance of their use. I next come to another point, to investigate which an important instrument has already been set up.

In organising the work for the eclipse of 1871, stress was laid on the importance of obtaining a photograph of *all* the light radiated earthwards during an eclipse, to supplement the work of the slit spectroscopes which had to do with the light radiated by *special parts* of the solar surroundings.

This work is a thousand times more important now that the spectrum of the prominences is so clearly separated from that of the corona by the prismatic cameras, because it enables us to make a flank attack, so to speak, on the corona spectrum.

The integrating spectroscope to be used on the 9th consists of a 4-inch Taylor lens of long focus as collimator directed to the sun's place during totality in a way I will state further on; then come two prisms of 60° of dense flint, and lastly a camera of 19 inches focus. The light reflected from a dark cloud gives an exquisitely sharp and well-dispersed solar spectrum in 40 seconds. During totality a plate will be exposed for 60 seconds.

Now in this instrument, simply pointed to the sun's place, the light from the greatest area will give the brightest lines. We may therefore expect the coronal lines to be well visible; and since the prismatic cameras are certain to give us a complete record of the chromosphere and prominence spectrum, a simple subtraction will bring us face to face with the spectrum of the upper reaches of the solar atmosphere.

I next come to another matter, on which it is necessary to lay great stress. It is well known that Prof. Newcomb, in 1878, introduced into eclipse work the use of a disc, behind which the brighter lower layers of the sun's atmosphere, apparently surrounding the dark moon, were hid during the totality. The object of this is, of course, to shield the eye, and an additional precaution is to blindfold the observer till totality has well commenced.

Armed in this way, Prof. Newcomb was enabled to see long luminous extensions equalling in length several diameters of the dark moon along the sun's equator. Now since such long streamers had never been seen before, it has been imagined that they indicate a special form of corona visible at the period of minimum sun-spot activity, for it was at very nearly this period that the eclipse of 1878 occurred.

But it may well be that the appearance may be due to the method employed, and that such an equatorial extension may be always there if only we can see it, and the greater the solar activity the more difficult is it to see it ordinarily, because this greater activity is always accompanied by a brighter lower corona.

Prof. Newcomb, I believe, used a disc of such a size that the brighter lower corona some 3′ above the dark moon was covered. I hope to repeat this observation, and to extend it by using several discs, one or more of which will cut off 5′.

Finally, I have a few words to say on the various features of the corona independently of the large extensions, which can best be specially dealt with by the disc observers.

Let us get photographic representations of this by all means; indeed amateurs are sure to provide them; but my own opinion is that a large telescope suited for obtaining such photographs would be much better employed with a prism in front of it.

I have no photographic telescope available, so I am forced to rely on drawings, which experience shows are better than photographs for feeble extensions. It is the fashion to ridicule these drawings, and I am free to confess that often there has been no resemblance between such drawings taken at the same place; still, all the eclipses I have seen have had coronas of very different forms; and further, the special features I recorded during the eclipse of 1878 were confirmed by the photographs.

On my way to Kiö, therefore, I determined to make an experiment, by the kind help of several of my shipmates on the Orient liner *Garonne*, to see how much the uncertainty of the result depended upon the absence of special training, and to what extent it could be eliminated.

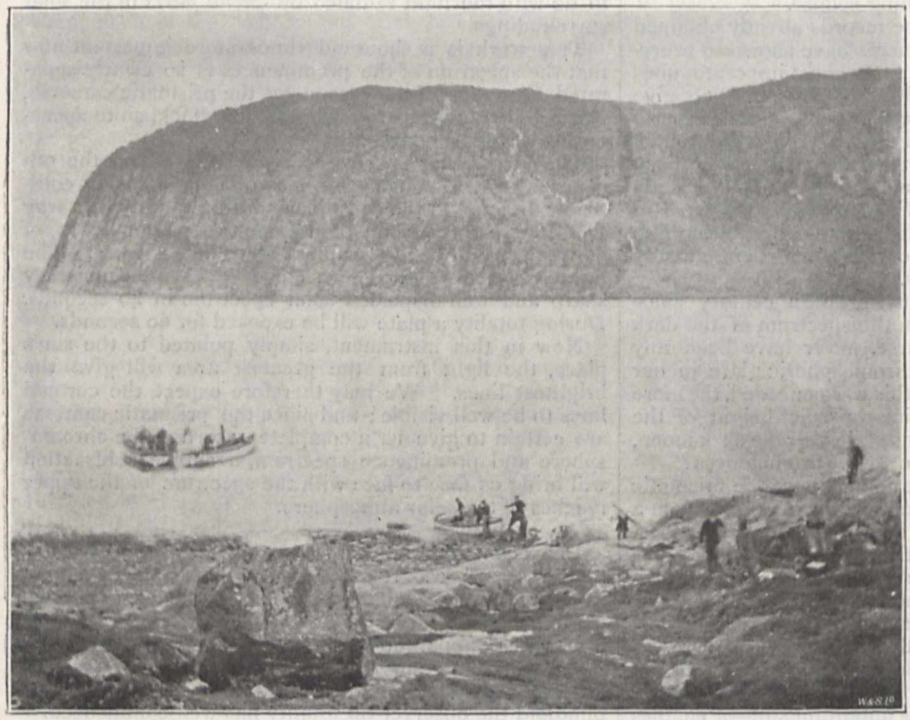

FIG. 1.—The landing of the Exploring Party.

With this object in view, by means of a capital magic lantern which we had fortunately on board, I threw on the screen about a dozen photographs and drawings, coloured and otherwise, of various eclipses observed since 1869, describing the main points to be noted at the sun's poles, equator, &c. Finally, I threw a previously unseen corona on the screen, marking the time—I took 105 seconds—as during an eclipse.

It was amply proved that after a rehearsal or two such as this all the drawings were wonderfully similar.

This new bit of experience therefore showed that when made under good conditions such drawings become of the utmost value.

The enormous difference between the shape and brilliancy of the corona at the periods of maximum and minimum sun-spot activity was one of the revelations—the *unanticipated* revelations—of the eclipse of 1878. In that year the appearances of the corona in 1871, a year of sun-spot maximum, were fresh in my mind, and fortunately the eclipse of 1878 occurred at the period of minimum. The difference was marked in every way, and I said so. For a time the statement was disputed, nay, ridiculed, but I think everybody accepts it now. The conclusion was further intensified during the eclipse of 1886, which also took place near a minimum. In that year the eclipse happened in the morning, the observation place was Green Island in the West Indies in the middle of the rainy season, and the only thing I saw was first a cloud which formed and began to obscure the sun soon after the first contact, and grew till after totality; and next, some patches of sky away from the cloud-eclipsed eclipse. These patches swarmed with stars as on a darkish night; full moonlight was never suggested.

The sun now occupies a position in the constellation Leo, such that besides planets many stars of the first, second, third, and fourth magnitudes are conveniently situated for observation. It is obvious then that we have here, if it be properly utilised, a method of photometry easily applied, and I propose if possible to utilise it, since where doubt exists the more methods of observation we employ the better.

Such, then, are some of the points to which I attach the first order of importance. I next pass on to deal with the station selected for the observations.

The longer totality and higher sun in Japan seemed to make a station in that country most desirable, but a careful inquiry into the weather conditions showed the hopelessness of any attempt there. I was then driven to Norway, and although it was true that the totality here was short, it had to be borne in mind that a short totality in the case of a prismatic camera is really more advantageous than a long one, for the reason that the rings are more complete; the longer the totality the shorter the arc impressed on each photographic plate.

Since Dr. Common and many others had determined to observe on the north side of the Varanger Fjord, it seemed a duty to go to the south side, where the weather chances were bound to be about the same. In this case, however, a man-of-war was necessary as a base. This was a matter of utmost congratulation, for I knew how surely help could be depended upon, even in extending the area of observations.

Thanks to the intervention of the Royal Society, H.M.S. *Volage*, commanded by Captain King Hall, was ultimately detached for this duty, and my story will be very badly told if I fail to show what a debt of gratitude science owes to him and his ship's company for what they have done to secure such a record of an eclipse as has never been attempted before at a single station, and I may add that the gratitude will be none the less even if the eclipse is as efficiently clouded out as it was ten years ago.

On July 23 H.M.S. *Volage*, coming from Iceland with most of the instruments on board, picked up at Hammerfest Mr. A. Fowler and Dr. W. J. Lockyer, who had been sent forward to erect and adjust them.

On the evening of the 24th the *Volage* arrived some seven miles south of Vadsö, and proceeded to land a party of explorers to find a suitable site for the encampment on the south side of the Varanger Fjord, which had been determined on, and also to make a survey of Bras Havn in order to find the most convenient anchorage.

After sending the party on shore, the *Volage* proceeded to Vadsö to communicate with the Governor (the Norwegian Government had already given permission to camp) as to the local weather conditions. The landing party, which consisted of Lieut. Martin and Sub.-Lieut. Beal, Mr. Fowler and Dr. W. Lockyer, and several bluejackets, together with Lord Graham, who had volunteered to help, proceeded to the shore in the steam cutter, having in tow the sailing cutter and the dingy, and provided with the necessary coal, water and provisions for two days. During the three-quarters of an hour steaming from the ship they encountered a sharp squall, which would have saturated everybody if it had not been for the invaluable sou'-westers and oilskins; and it is well here to note that if one goes to the north of Norway, these should always be found in the kit together with a pair of sea-boots.

The party landed, however, safely on a small island on the eastern shore of Bras Havn, and commenced immediately to put up tents. By eleven o'clock p.m., local time, all preparations were finished. The evening turned out so beautiful that a chat round the camp fire and a drop of grog were indulged in before turning in.

The first morning on this island was not by any means cheerful, rain was coming down in torrents, and the wind whistled round the tents in a most unwelcome manner. It was decided that the survey of the bay should be taken in hand first, so Lieut. Martin, Sub.-Lieut. Beal, and Lord Graham started off in the steam cutter and commenced operations. The weather did not improve, but rather the reverse; the survey, however, made good progress notwithstanding the unfavourable conditions, but all hope was given up of finding on that day a site for the observatory on the island near by.

Sunday morning was of a different type, and work was commenced at an early hour. Mr. Fowler and Dr. W. Lockyer were landed on Kiö Island while the survey was being finished. The island of Kiö lies nearly north of Bras Havn, at a distance of about a mile and a quarter. The island itself is small, and consists of gneiss moutonnéd and polished to a wonderful degree, the surface putting on the appearance of snow in many places. The rock is covered here and there with peat. At the first glance it seemed that a suitable site for the observatory was out of the question, but on examination a very fair spot was selected which appeared to improve the more acquaintance was made with it. To economise time the sites for the concrete pillars were settled upon, and pits were dug in the peat to sound for the solid rock.

With the evening came the *Volage* from Vadsö, and her arrival was gladly hailed by the whole surveying party, as provisions had run rather short, and peat water was not regarded as a luxury. The return of the ship meant that work could now be begun in earnest, so plans were laid for an early start on the morrow. Fortunately the day proved fine, and a good start was made at putting up the large 6-inch hut. This is the time when a warship at one's back makes everything easy. The gunner turned bricklayer for the occasion, and commenced, with the help of a couple of bluejackets, mixing and setting up concrete pillars for the 6-inch and siderostat. The ship's carpenters, with their assistants, went to work with zeal with the erection of huts. Others were employed in fetching from the beach sand and stones, which were required for the concrete pillars.

Levelling the camp occupied also the time of another half-a-dozen bluejackets. At the close of the day's work the appearance of the spot had entirely changed, and the Lapps who came and watched the work seemed to be very much astonished at the alterations taking place on their island. They were, however, very friendly, and seemed to be only too pleased to help in any way they could; their assistance, however, was not required, as sufficient was at hand.

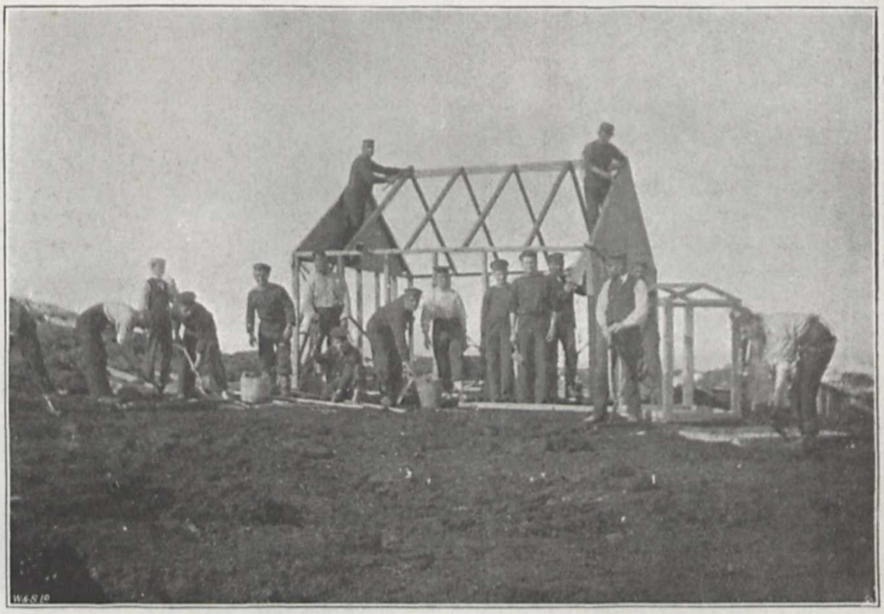

FIG. 2.—The erection of the Huts.

The following day, which proved fine, saw even greater progress; for besides erecting the 6-inch prismatic camera and siderostat, a party of bluejackets was employed in carrying stones from the beach to place on the peat covering the floor of the camp. This was done in sailor fashion, and at the word of command "stone camp," the small path leading upwards to the camp was lined with bluejackets, and buckets, full and empty, were passing up and down respectively. The scene was an interesting one to watch, and, after two hours' work, a geologist might have found a genuine raised beach.

Bad weather, however, now set in, so work was restricted for the next two days mostly inside the huts. The integrating spectroscope was put together, photographic dark slides were blackleaded to run more easily in the grooves of the cameras, and two more tents were put up to protect the 9-inch prismatic camera and integrator from the weather. The latter was composed of ship's materials, a sail being used for the covering; the tent served its purpose well, and withstood, like the others, a heavy blow from the east.

The two wet days were followed by two very fine ones, and great advance was made.

The foregoing account will give an idea of the kind of work done up to the end of August, the day of my arrival at Kiö. It was impossible for me to join the advanced party, so I subsequently proceeded direct to Kiö in the Orient liner *Garonne*. After a delightful voyage through the most wonderful of the Norwegian fjords under perfect travelling conditions, Captain Veale was good enough to slightly alter his course so as to drop me on the day named at a point about two miles north of the island, where I was met by the boats of H.M.S. *Volage*, which soon transferred the rest of the instruments and myself to the Eclipse camp.

It will have been gathered that when I arrived at Kiö, all the fixed instruments brought out had been erected and adjusted as far as possible. I put in this qualification because, of course, all star observations were out of the question, as the sun at midnight was only 4° below the horizon.

Furthermore, profiting by the good will and keenness to assist on the part of the officers, full complements of assistants had been secured for the various manœuvres requisite to obtain the greatest amount of results in the restricted time covered by the totality.

But Captain King Hall was not satisfied with this contribution to our endeavours. He inquired whether the services of other volunteers would be of any help to us. I replied that there was so much to be done that I thought I could usefully occupy all possible volunteers if the detail of duty on board left any time for instruction and training. I was at once taken at my word, and was requested to give, in lecture form, in the forecastle that evening a statement of what was required, and why it was useful to try to do it. This was done by the help of the magic lantern, which had been kindly lent me by the *Garonne*, the deck being darkened by sails laid over booms. After it was over the Captain called for volunteers. Many at once responded to the call, and, to make a long story short, I may say that at present the number of volunteers, including officers and men, is over 70.

The first thing to be done next morning with this wealth of help was to set to and compose a programme of eclipse work beyond all precedent.

FIG. 3.—The Volunteers.

It was at once determined to form groups to sketch the corona, to note the stars visible during totality, to note the changes of colour of the landscape, discrimination being made between cloud, sky, and land and sea surfaces; to erect several discs cutting off the lower corona to different heights; and the swoop of the shadow of the moon was not neglected.

Further, as I had brought small polariscopes, prisms, and slit spectroscopes with me, other groups evidently had to be formed to use these instruments.

Two things then obviously had to be done at once—to select the artists and to start some spectroscopic demonstrations among the more scientific-minded. Captain King Hall at once gave up his fore cabin for the one, and Staff-Surgeon Whelan lent spirit-lamps for the other.

The first competition among the volunteer artists took place at 9 p.m. on Tuesday, 4th, that is, the day before yesterday, and was repeated last night. There were about thirty-five entries. Ten marks were given for form, ten for colour. As on the *Garonne*, after a brief description, with photographs on the screen of the things to be looked for, and the lie of the sun's axis to the horizon of Kiö, a previously unseen coloured drawing of the eclipse of 1869, and a copy of Langley's drawing of that of 1878, were thrown on the screen, and the 105 seconds given out in proper eclipse fashion by means of a stop-watch. The similarity among the drawings on both occasions, and the accuracy of the notes on colours were truly marvellous; many full marks were accorded, and as a result sixteen of the volunteers were secured for the sketches of the corona, eight for the colours of the landscape, and four for observations of the moon's shadow. For the disc parties there were six volunteers, Captain King Hall himself taking charge of the first. For this work keen eyesight was, of course, of the first importance. The drill I had suggested for the officers of the Training Squadron is adhered to, the real observer being blindfolded till 10 seconds after the beginning of totality.

Of the Spectroscopic Classes little need be said; they include nine volunteers, and work has already begun.

The distribution of work among our party is now as follows:

Fixed Instruments.

1.	6-inch prismatic camera	5
2.	9-inch " "	6
3.	Integrating spectroscope	4
4.	Discs	6
5.	6-inch grating spectroscope...	6

Other Observations.

6.	3¾-inch telescope	2
7.	Sketches of corona	16
8.	Colours of landscape	8
9.	Moon's shadow	4
10.	Slit spectroscopes	4
11.	Prisms for rings	2
12.	Polariscope	2
13.	Timekeepers	3
14.	Contacts	4
15.	Thermometers	6

Thus making a total of 78.

FIG. 4.—The Officers of H.M.S. *Volage*.

Three main stations were next fixed upon: Kiö, as headquarters; an island lying between Kiö and the *Volage*, on which a signal station has been erected to convey messages to and from the ship; and finally the top of the majestic cliff near which the ship was lying.

Before I pass from this part of the subject, it may be stated that the volunteers are from almost every rating. Besides the officers there are—I name them in the order in which they appear in the muster rolls of the various parties—petty officers, signalmen, marines, A.B.s, ordinary seamen, stokers, blacksmiths, shipwrights, engine-room artificers, and boys.

Very many inquiries were made at the various stopping-places in the north of Norway concerning the chances of fine weather in the neighbourhood of Vadsö. The English Consul at Hammerfest, where H.M. *Volage* picked up Mr. Fowler and Dr. W. Lockyer, informed them that the question of clear or foggy weather depended almost entirely on the direction of the wind. An east wind at Vadsö meant foggy weather, a west wind fine; the reverse was the case at Hammerfest. It was also mentioned that the south side of the Varanger Fjord seemed to be more free from fogs than the northern shore. The news seemed very encouraging, since it was proposed from the beginning to settle on the southern side. It was also made manifest that it would be unwise to select an elevated spot, since clouds and mists often were seen hanging about at 100 feet and over, while the lower levels rema ned clear. The experience, gathered from the first few days spent on the southern shore, did not, however, bear out very exactly the Hammerfest information. The 24th and 25th were both miserably wet days, and yet the wind was blowing hard the whole time from the north-west. The following two days were very fine and hot, the wind coming from the eastward. But the view as to the necessity of a low elevation has been quite justified by what has taken place here.

When mists were prevalent, Kiö has always been better off than the surrounding country. The hills to the south-east and south-west have often been wrapped in mists, while the eastern horizon at the camp has been as clear as a bell. So far we have only experienced one fog.

The weather so far has seemed to have a two-day period, two fine days following wet days. The 29th and 30th were wet and windy days, while the two following ones were moderately fine. On the s.s. *Garonne* I had an opportunity of consulting two pilots well acquainted with the Veranger fjord, and both informed me that the characteristic feature of the weather was that the mornings were fine and the sky was overcast later. This has so far in the main proved accurate. The eastward horizon (we have a sea horizon) has been nearly always clear in the earlier part of the morning, *i.e.* about six a.m., while towards six p.m. it was invariably cloudy. This gives us good encouragement, and make our chances of fine weather at the time of the eclipse very hopeful. And it may be stated, further, that the chances are that even if the eclipse morning proves misty, our place of observation will be the best available, and only clouds will prevent a successful issue.

J. NORMAN LOCKYER.

(*To be continued.*)

NOTES.

SIR GEORGE BADEN-POWELL did science a very important service when he conveyed a small party of observers to Novaya Zemlya to record the characteristics of the eclipse of August 9. Mr. Norman Lockyer points out in the *Times* that, thanks to this timely aid, the failures in Norway and Japan are much less disastrous than they otherwise would have been. He has received a code telegram from Mr. Shackleton, one of his assistants who accompanied Sir G. Baden-Powell, stating that results just short of the best possible have been obtained. The programme of work arranged for Novaya Zemlya included a series of twenty-two photographs with the prismatic camera (that is, a long photographic camera with two large prisms of 60° in front of the lens). The exposures were to begin thirty seconds before totality, and were to end shortly after it. They varied from snap-shots to forty seconds. The times of exposures were arranged to secure specially the spectrum of the corona. Besides this work, to which the highest value is attached, three photographs of the corona were to be obtained with a long focus telescope of 4-inch aperture. It is a matter of congratulation that these instruments have been utilised, and as Dr. Stone, who also accompanied the party, was probably equally successful in making observations, we may say that the eclipse has been saved from entire failure, so far as British astronomers are concerned, by Sir G. Baden-Powell's assistance. As to Russian observers, a Reuter telegram from St. Petersburg, August 20, says:—"The Russian astronomical expedition, which was sent to the north of Finland to observe the solar eclipse, telegraphs from Tornea that, owing to the magnificent weather which prevailed at the time, ten good photographs of the corona were obtained by means of three different apparatus. The Hydrographical Department has received a telegram from General Baron Maidelicheff, of the Saghalien astronomical expedition. The message, which was despatched from Cape Notoro, the south-western extremity of Saghalien, states that the observation of the eclipse was fairly successful, and that, although the sky was cloudy, two photographs of the corona were obtained. Some magnetic variations were noticed during the eclipse."

AT the moment of going to press, the following details have been received from Mr. Shackleton, with reference to his observations at Novaya Zemlya:—"I obtained about eight photos during totality. The most successful are those at the beginning of the eclipse, also at the end and the long exposure near mid-totality. The two photos near the beginning of totality are very interesting: the one nearest the time of the beginning of totality shows, I think without doubt, as many bright lines as there are in the Fraunhofer spectrum with the same instrument, so in all probability we have succeeded in photographing the 'reversing layer.' The plate at the end of totality also shows a great many lines, but not as many as at the beginning; probably they are the same as those photographed by Mr. Fowler in the metallic prominences of 1893—certainly most of them are. The long exposure near mid-totality gives a good ring at 1474 K, and also one near K (3969 λ), and several other fainter ones. The spectra are not so extensive in ultra-violet lines as those of 1893, probably because of the cloudy state of the sky. The corona-photos have also come out very well." We propose to refer more fully to the Novaya Zemlya observations in an article in our next issue.

THE Royal Society was represented at the funeral of Sir John Millais, on Thursday last, by Dr. Michael Foster and Sir Joseph Fayrer. Among other scientific bodies, which honoured art in the person of the late President, were the Society of Antiquaries, the Royal Astronomical Society, the Linnean, Chemical, and Geological Societies, the British Museum, the Royal Geographical Society, the Institution of Civil Engineers, the Colleges of Physicians and Surgeons, and the Royal Institution of British Architects.

THE success of Sir Martin Conway's expedition to Spitzbergen was noted in our issue of August 6. A Reuter's telegram from Tromsö, dated August 21, states that the whole party had arrived there on their way home. Mr. Garwood and Mr. Trevor-Battye had left the main party in Spitzbergen in order to explore Horn Sund, and they succeeded in reaching and ascending Hornsund Tind, a "marble mountain" in the middle of Southern Spitzbergen, which has hitherto only been seen from the sea. They studied the geology and glacier systems of the surrounding country, and encountered serious difficulties on account of the boisterous weather. By no means the least daring part of their journey was the return from Spitzbergen to Norway in a small steam launch of less than twelve tons, necessarily a much less seaworthy craft than a sailing boat of the same size.

A REUTER telegram states that the Danish cruiser *Ingolf* returned to Copenhagen on Thursday last from a long voyage, under the leadership of Commodore Wandel, undertaken for the purpose of exploring the navigable waters round Iceland. The expedition, which lasted two years, was highly successful. In the southern part of Davis Strait the explorers discovered a submarine mountain range. The scientific results, especially from a hydrographical and zoological point of view, are said to be exceedingly valuable.

WE regret to announce that Prof. A. H. Green, F.R.S., Professor of Geology in the University of Oxford, died on Wednesday, August 19, at the age of sixty-four. We also notice with regret the death of Dr. Rüdinger, Professor of Anatomy at Munich Observatory; Mr. Frederick Brodie, whose name will be remembered by many astronomers in connection with drawings of Donati's comet of 1858; and Miss G. E. Ormerod, the sister of the well-known entomologist. Miss Ormerod took an active share in her sister's useful work.

HARVARD UNIVERSITY, and geology, have lost a distinguished worker by the death of Prof. Josiah Dwight Whitney. From a notice in the *Times*, we gather that Prof. Whitney was born at Northampton, Massachusetts, on November 23, 1819. He graduated at Yale in 1839, and in the following year he joined the survey of New Hampshire as assistant geologist under Mr. C. T. Jackson. Two years later he went to Europe, and pursued his studies in chemistry, geology, and mineralogy. On his return to America in 1847 he investigated the geology of the Lake Superior region, being appointed with Mr. J. W. Foster to assist in making a geological survey of the district. In 1855 he was appointed State chemist and professor in the Iowa University, and was associated with Mr. James Hall in the geological survey of that State, of which he published an account. From 1858 to 1860 Prof. Whitney was engaged on a geological survey of the lead region of the Upper Missouri in connection with the official surveys of Wisconsin and Illinois. He was appointed State geologist of California in 1860, and conducted a topographical, geological, and natural history survey of that State till 1874, when the State Legislature discontinued the work. Besides numerous pamphlets and annual reports, Prof. Whitney issued "Geological Survey of California" (six vols., Cambridge, 1864–70). In 1865 he was appointed Professor of Geology at Harvard University, and retained the chair till his death. The honorary degree of LL.D. was conferred on him by Yale in 1870. Prof. Whitney was one of the original members of the National Academy of Sciences named by Act of Congress in 1863, but he subsequently withdrew from that body. He was a member of a large number of scientific bodies, both at home and abroad. He translated Berzelius's "Use of the Blowpipe" (Boston, 1845), and he wrote a guide-book to the Yosemite (San Francisco, 1869). It is a significant testimony to his scientific eminence that Mount Whitney, the highest mountain in the United States, is named after him.

AN International Exhibition of Gardening will be opened at Hamburg at the beginning of May next, and close at the end of September. The Exhibition is intended to comprise all branches of gardening and the cultivation of all kinds of plants.

THE fourth International Congress of Criminal Anthropology was opened at Geneva on Monday, and is to last till Saturday. Great Britain is officially represented, and Mr. Francis Galton, F.R.S., is among those who are down to read papers at the Congress.

THE Paris correspondent of the *Chemist and Druggist* states that the crypt made under the principal entrance of the Rue Dutot Institute, which is to contain Pasteur's tomb, is rapidly approaching completion. At the entrance of the vault is the following inscription in French:—"Happy is he who carries within himself a God, an ideal of Beauty, and obeys it; an ideal of Science, an ideal of the virtues of the Gospel." In the interior the arches are decorated with groups of animals, surrounded by frameworks of vines, mulberries and hops. Symbolical winged figures, representing Faith, Hope, Charity, and Science, appear in the centre of the cupola, forming a highly artistic group, and one which is identified with the illustrious savant's character. It is probable that the remains of the great chemist will be transferred to the Institute from Notre Dame on December 27, the anniversary of his birth.

THE International Exhibition to be held in Brussels next year promises to be of a very important character. Though commenced as a private enterprise, it is now a national undertaking, assisted by the State, and having as its patron King Leopold, while the Count of Flanders has accepted the honorary presidency. The French Government has made a grant of £35,000; Germany has so far voted no money, but has formed a powerful commission, under the presidency of Prince Charles of Hohenzollern; the United States has made a grant; the South American Republics will, in nearly all cases, be represented, and it is expected that there will be Italian, Russian, Austrian, and Scandinavian Courts. As for this country, the Government is taking an interest in the success of the undertaking, and at its request a British Commission has been formed under the presidency of Sir Albert Rollit, and with Mr. James Dredge, one of the editors of *Engineering*, as executive commissioner. It is hoped that British science, art, and industry will be worthily represented at the Exhibition.

WITH reference to the period of extremely hot weather in the United States, a correspondent writes:—"The hot weather began on August 4, and for eight days succeeding was felt over the greater part of the United States. The deaths on Tuesday, August 11, both in New York and in Brooklyn, surpassed all previous records, but were again exceeded on the following day. In the twenty-four hours ended at noon, August 13, 374 death certificates were filed at the Bureau of Vital Statistics in New York City. Of these the cause of death given in 158 cases was sunstroke. The total number of fatal sunstrokes in eight days was 617. Coroners and undertakers have been unable to dispose of the dead with sufficient speed to protect the health of the living. Lower animals, horses, dogs and cats, have died by thousands. Over one thousand horses perished in New York City, and facilities for removing the bodies were so inadequate that many remained for days where they fell. Some of the busy thoroughfares of the city were strewn with dead horses like a field of battle. In one instance, eighteen were said to be lying in one street within a short distance of each other. Brooklyn fared somewhat better on account of its proximity to the ocean; but Chicago was stricken almost like New York City. In many smaller cities similar effects were produced, and it will be impossible ever to make an accurate statement of the total fatality. In the Central Western States, the temperature rose to 110° and 115° in structures exposed to the sun at many points, and even 125° was reported from portions of Illinois, not, of course, in shaded observation stations, but in inhabited buildings."

THE seventh annual meeting of the Museums Association, held at the latter part of July in Glasgow, was a most successful one from every point of view, and in some of its importan features it exceeded any of the previous conferences. The whole of the arrangements for the meeting were carried out by the Corporation of Glasgow, who gave a very cordial welcome to the Association, and offered them every facility for inspecting the museum schemes, some developed and others developing, which mark Glasgow out as probably one of the most advanced in the kingdom in its recognition of the important value of museums and art galleries to the people of a great community. In Kelvingrove Park the Corporation are erecting a science and art museum of palatial dimensions at a cost of over a quarter of a million, and while thus recognising the need of a central building, adequate to the exposition of science and art in its broadest sense, they have endeavoured to meet the natural requirements of an extensive city by establishing subsidiary museums in various parks and open spaces, the latest of these being the Camphill Gallery in Queen's Park, devoted at present to special exhibitions. In his presidential address Mr. James Paton, Curator of the Galleries and Museums, gave an interesting account of their foundation and progress. The papers read at the meeting included such practical subjects as descriptive labels for geological collections, by H. Bolton. electrotypes in Natural History Museums, by F. A. Bather; Type specimens in Botanical Museums, by E. M. Holmes; Chemistry in Museums, by George W. Ord; illustrated lectures in Museums, by Thomas Rennie; the lighting of Museums, by Thomas White; and a paper by F. A. Bather, on how may Museums best retard the advance of science, in which in a satirical vein he pointed out how the storage or even exhibition of specimens is not necessarily conducive to the elucidation of their history and structure. In addition to the various Glasgow museums, the members of the Association paid a visit to Perth, on the invitation of the Lord Provost, and they there had the opportunity of inspecting, under the able guidance of Mr. Henry Coates and Mr. Alexander M. Rodger, one of the most recent, as it is the most interesting and attractive, museums of a purely local character that has ever been formed in Britain.

THE interest of Prof. Ewart's experimental stud at Penicuik, Midlothian, was increased, a few days ago, by the arrival of a hybrid between a male Burchell's zebra (*Equus burchelli*) and a mare (*Equus cabattus*). Though the mare is jet black, the foal, except over the hind-quarters, has as many bands as its zebra parent. The bands are fawn-coloured, the background nearly black. But though the hybrid by its stripes suggests the zebra, in form it closely resembles an extremely well-bred foal. Should the mare have a foal to Prof. Ewart's Arab horse "Benazrek," provided with stripes and other zebra-like features, an important step will have been made in justifying breeders in believing in Telegony, or, as it is familiarly called, "the infection of the germ." When the present hybrid colt and the hybrids expected next summer reach maturity, it will be alike interesting and important to ascertain whether they are fertile with each other, and with pure horses, zebras, and asses.

IN a very interesting paper on the geology of Novaya Zemlya (*Izvestia* of the Russian Geographical Society, 1896, i.), Prof. Chernysheff points out the difference which exists between the middle parts of the island and its southern part. The latter, which must be considered as a continuation of the Pai-kho, or northern Ural ridge, is a plateau consisting of Lower Permian deposits (Artinsk layers) stretching north-west; while in the north of Bezymyannaya Bay (72° 40′) the island consists of an Alpine region, rising to an altitude of 4000 feet, and is built up of Devonian rocks, stretching north-east, and intersected by deep transversal valleys of aqueous origin, such as Matochkin Shar, and several others. It may be added to this fundamental fact, fully established by M. Chernysheff, that we should thus find in Novaya Zemlya a repetition of what is seen further south in the Urals, which also consist of plateaus stretching north-west, and of chains of mountains having a north-eastern direction. The whole of the island has been extensively glaciated. Immense moraines have been accumulated at levels which are much higher than those on which we now find *firn*-fields in the south, and in the north big moraines are found, where there are no glaciers at the present time, or only very small ones. The glaciation of Novaya Zemlya was contemporaneous with the glaciation of North Russia, and was followed by a period of subsidence, during which an archipelago of small islands was all that remained of the big island. Terraces of marine origin, containing shells of molluscs now living in the Arctic Ocean, are admirably well developed along the shores, up to an altitude of 160 metres above the sea-level. At the present time the island is in a period of upheaval, and its glaciers are again on the increase. Large fields of *firn*, in which the ice has the same structure as in glaciers, are spread over the southern plateau; while further north, in the Alpine tracts, young glaciers are being formed; so that if the same conditions continue to prevail, the island will become again the ice wilderness it formerly was.

PROF. A W. RÜCKER contributes to the July number of *Terrestrial Magnetism* a summary of the results of the recent magnetic survey of Great Britain and Ireland, conducted by Dr. Thorpe and himself. Prof. Rücker presents his valuable summary under three heads. (1) On the accuracy of the delineation of the terrestrial isomagnetic lines. (2) On the accuracy of the determination of the local disturbing magnetic forces. (3) On the relation between the magnetic and the geological constitution of Great Britain and Ireland. Illustrations accompany the article. An investigation of magnetic disturbances during the interval 1890-95, as taken from the records of the Potsdam magnetograph, is described by G. Lüdeling. For this interval the author fails to find a marked relationship between the annual curve of sun-spot frequency and the annual variation of magnetic disturbances. There is, however, a close correspondence in the diurnal and in the annual variation of the disturbances and of polar lights as observed at Oxford.

THE mode by which light and Röntgen rays are able to bring about the discharge of an electrified surface, is discussed by Dr. Oliver Lodge in *Science Progress*. Experiments were carried out by him with the object of testing the presence of metallic particles or vapour near an electrified metal rapidly discharging under the action of light. The results lead to the conclusion "that the discharge of electricity from illuminated surfaces is not effected by evaporation of those surfaces, but that the molecules, which convey the charge, belong to something in the gas, and not to the illuminated body." It is suggested that the discharge of an electrified surface by Röntgen rays—an action which seems to be brought about by the conversion of the gas, or other insulating material, near the charged body into a conductor—is probably effected "by dissociating the substances into charged atoms which are then free to act as carriers, and speedily convey to a distance the charge of an electrified body by journeys along the lines of force. It may be that ultra-violet light acts in somewhat the same way, but not in exactly the same way." As to the nature of the rays, everything now indicates them to be transverse vibrations, and Dr. Lodge thinks their wave-lengths are not much greater than the size of atoms.

PROF. VICENTINI, whose microseismograph has been noticed several times in these columns, has recently erected at Padua an important modification of his instrument. His original microseismograph at Siena consists of a pendulum whose bob remains nearly steady during rapid vibrations, and the movements of the ground are magnified, first by a vertical lever, and still further by two horizontal levers at right angles to one another. In this form, it is most useful for giving the times of the different phases of a disturbance; but, owing to the comparatively small velocity (2 mm. per minute) of the paper on which the movements are recorded, it furnishes but little information as to the direction of the displacements. At the suggestion of Dr. Pacher, the pair of horizontal levers has been replaced by a small and very light pantagraph; the weight of the bob has also been increased from 50 to 100 kg., the length of the pendulum from 1·50 to

3·36 metres, and the velocity of the paper to about 15 mm. per minute. The diagrams are of course distorted in the direction in which the paper moves, and they no longer give the exact times of particular phases; but, acting in concert with the older form, the new microseismograph furnishes valuable data with regard to the character and direction of the pulsations. In the paper by Prof. Vicentini and Dr. Pacher, in which these changes are described (*Atti del R. Ist. Veneto di scienze*, &c., vii., 1896), two interesting diagrams are reproduced, both corresponding to very distant, but unknown, earthquakes—one on December 25, 1895, and the other on January 15, 1896.

WE have received from Dr. Joachim Sperber, of Zurich, a *brochure* of 37 pp. on the parallelogram of forces regarded as the basis of the periodic system in chemistry. After applying the principle to a number of numerical calculations, the author remarks in conclusion, that the stereochemistry of carbon and nitrogen is nothing but a case of resolution into components in different directions. The paper is published by E. Speidel, of Zurich.

AMONG the 300 species, or thereabouts, of plants which Lundström and others describe with more or less accuracy as acarophilous, no gymnosperms or monocotyledons have hitherto been included, but Dr. de Gasparis, in the *Rendiconto della R. Accad. delle Scienze fisiche e matematiche* (Naples), describes a monocotyledon *Scindapsus dilaceratus* as having *Acarus*-galls produced freely at the bases of the leaf-segments. He describes them as being produced undoubtedly as the result of puncture, and details the changes which take place in the mesophyll of the leaf, resulting in a small chamber surrounded by many layers of special cells. Although he apparently accepts Lundström's view that these *Acarus*-galls are a strict case of symbiosis, the plant profiting alike by the secretions of the *Acari*, and by the latter consuming fungus spores, &c., which otherwise might germinate upon the epidermis of the plant, he produces no evidence to show that in this particular case symbiosis exists

WE have received from the agricultural department of the Glasgow and West of Scotland Technical College a *brochure* of seventy pages, embracing reports on experiments on the manuring of oats, hay, and turnips, on finger-and-toe in turnips, and on the spraying of potatoes, conducted in 1895 by Prof. R. P. Wright and others on farms in the south-west and centre of Scotland. The results of the experiments upon the oat-crop indicate that nitrogenous manures, such as nitrate of soda and sulphate of ammonia, applied alone, retard ripening, but give large and profitable, though somewhat irregular, increases of crop; also that these nitrogenous fertilisers are more uniform and more regular in their action when applied with a soluble phosphatic manure, particularly superphosphate of lime. In the case of the fungoid disease finger-and-toe—known also as club-root or anbury—confirmation is afforded of the previously ascertained fact that liming, if done early, will benefit a crop of turnips on land where the disease is prevalent. The spreading out on lea land of diseased roots to be consumed by stock is very properly condemned. It may be mentioned that finger-and-toe is very prevalent this season, especially in Scotland and the North of England, and it is no doubt a source of serious loss; the pathogenic organism is *Plasmodiophora brassicæ*. It is difficult to understand why the spraying of the potato crop with *bouillie bordelaise*, as a check upon the potato disease, should give such indifferent results in Scotland, whilst the practice has been attended by substantial benefit in England and France, and particularly in Ireland. We quite agree that, at present, "it would be rash to draw definite conclusions" from the general results of the experiments that have hitherto been made in Scotland.

MESSRS. G. BELL AND SONS have sent us an advance prospectus of a work they are about to publish under the title "Men and Women of the Century." The work comprises a series of portraits of notable men and women who have sat to Mr. Rudolf Lehmann between the years 1847 and 1895, each portrait signed with the autograph of the sitter. There will be twelve photogravures, from paintings, and about seventy facsimile reproductions of the drawings in half-tone, some of them printed in colours, and all executed by the Swan Electric Engraving Company. Among the scientific men whose biographies and portraits are given are the following:—A. von Humboldt, Louis Pasteur, Sir Richard Owen, Prof. Virchow, Prof. Huxley, Prof. Burdon Sanderson, Prof. Mommsen, Prof. Max Müller, Prof. Du Bois Reymond, Sir William Siemens, von Ranke, Sir David Brewster, Sir Henry Bessemer, and Sir Spencer Wells. The collection will thus form an interesting private gallery of contemporary portraits. It is edited by Mr. H. C. Marillier, who contributes an introduction and the short biographical notices.

THE additions to the Zoological Society's Gardens during the past week include a Capybara (*Hydrochærus capybara*) from South America, presented by Mr. F. W. Temperley; a —— Fox (*Canis* ——) from Nicaragua, presented by Mr. F. A. Pellas; a Black-necked Grackle (*Gracupica nigricollis*) from China, presented by Dr. Nowell; a Salt-water Terrapin (*Clemmys terrapin*) from Florida, presented by Miss Hole; two Brush Turkeys (*Talegalla lathami*) from Australia, deposited; a Yak (*Poëphagus grunniens*, ♂); an English Wild Cow (*Bos taurus* var.), a Wapiti Deer (*Cervus canadensis*, ♀), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL CONSTANTS.—Some account of the completed work of Drs. Gill and Elkin on the determination of astronomical constants by means of heliometrical measurement is given in the *Bulletin Astronomique* for August. The values there given differ by minute amounts from those contained in the preliminary paper published in the *Monthly Notices* for April 1894. For Solar Parallax the following values have been derived:—

From observations of Victoria ...	8″·8013 ...	±0″·0061
,, ,, Sappho ...	8·7981 ...	±0·0114
,, ,, Iris ...	8·8120 ...	±0·0090
Mean value	8·8036 ...	±0·0046

The value given by the Iris measures is slightly greater than that from the other asteroids, and the suggestion is made, but not insisted upon, that this might be explained by the light of Iris being somewhat less refrangible than that of the stars with which it has been compared, a fact that Dr. Elkin has noted in the course of his observations. Prof. Newcomb has pointed out that a not impossible difference between the spectrum of the planet and star could affect the resulting parallax to the extent of two or three hundredths of a second. Since, however, the mean value of the parallax does not differ from that derived from the observations of Iris by more than the probable error, no definite conclusion can be drawn on this point.

The value of the moon's mass, derived from the discussion of the observations of Victoria is

$$\frac{1}{81 \cdot 702 \pm 0 \cdot 094} = 0 \cdot 012240 \pm 0 \cdot 000015.$$

This result is believed to be free from the effects of any systematic errors.

The Constant of Nutation is given as 9·2068″ ± 0·0034″, a value that lies midway between the generally accepted values of Newcomb and Chandler, viz. 9·210″ and 9·202″ respectively. This satisfactory agreement again points to the successful elimination of all systematic errors.

SMALL PLANET OBSERVATIONS.—The asteroid Abundantia, No. 151, has offered for solution a very curious problem. Since its discovery in 1875, it has been observed, or at least observations purporting to refer to that planet have been made, at seven oppositions. When these are submitted to rigorous treatment and the perturbations carefully computed, it is found that the observations in 1875, 1879, 1886, and 1887 can be represented with satisfactory accuracy, but the observations of 1881, 1885, and 1894 cannot be satisfied with the same elements. While the normal places formed from the first-mentioned four years have only nominal errors, those in the other years present the following deviations :—

		s.		′ ″
1881	...	$d\alpha = + 25{\cdot}29$	...	$d\delta = - 2\ 19{\cdot}1$
1885	...	,, $= + 38{\cdot}20$	...	,, $= - 2\ 0{\cdot}8$
1894	...	,, $= + 30{\cdot}48$	...	,, $= - 3\ 55{\cdot}3$

The obvious explanation that some numerical error in the calculations has led to this unusual result is excluded by the detail that Lieut.-Col. von Groeben has given in his description of the processes employed (*Ast. Nach.*, No. 3372). To suggest that another small planet exists moving in a similar orbit, and at present in a very similar position in that orbit, is likely to meet with opposition. The difficulty remains, however, unexplained. The similarity of the deviations from the computed path of Abundantia, both in amount and in direction, is a suspicious circumstance which, however, does not offer a definite clue. Future observation must be looked to for the explanation of the enigma, and von Groeben furnishes an ephemeris for 1896 November, which may induce observation and supply the solution of the riddle. Photographs of the district seem to offer the most likely solution, since the existence of the hypothetical planet, probably of equal brilliancy with Abundantia, should declare itself on the photographic film at no greater distance from the real or known planet than is shown by the errors above.

CYCLES OF SOLAR ECLIPSES.—In the *Bulletin de la Soc. Ast. de France* for July 1896, p. 248, M. C. Flammarion gives the history of the recent eclipse as an example of the well-known period of 18 years 11 days, the Saros, and in the course of the paper several new points are elucidated. Thus in considering any set of solar eclipses, the constants of each are found to vary regularly according to the position in the cycle. Taking the place on the central line where an eclipse begins, the next eclipse in the cycle, after an interval of 18 years 11⅓ days, will begin at a place about 118° west longitude, while another similar period will cause the third eclipse to begin in very nearly the same longitude as the first one. When plotted on a globe, the traces of the consecutive shadows appear curiously regular in the form of a triangle round the pole.

In latitude each eclipse begins a little *north* of its predecessor; the difference is about 8° for the beginning of eclipse, 4° for the middle, and 2° for the end. Continuing, it is found that the fourth eclipse has a path almost parallel to the first, but much to the north. It thus appears that in a given region a solar eclipse will recur after an interval of three ordinary cycles, each of 18 years 11⅓ days.

This secondary period of fifty-four years comprising three metonic cycles, M. Flammarion thinks has been unnoticed, and the remarks that it may prove more useful than the smaller period, or Saros, in predicting solar eclipses. There appears to be a regular march of the line of totality from the south to the north pole, the time taken being ten of the long cycles, or about 540 years.

STARS HAVING PECULIAR SPECTRA.—Prof. E. C. Pickering, in *Ast. Nach.*, 3370, gives details concerning the spectra and positions of eighteen stars which have been found by Mrs. Fleming to possess peculiar spectra, giving suspicion of variability. Seven of these are set down as being of Type IV., but three only are of the normal type, the remaining four containing lines of shorter wave-length. New evidence has been obtained regarding two objects previously announced as having peculiar spectra, in *Ast. Nach.*, vol. cxxxv. p. 195, and they are now shown to belong to a different type to that formerly given. One of these, whose position for 1900 is R.A. = 17h. 38·2s., Decl. = − 46° 3′, was thought to be a stellar object having the spectrum of a gaseous nebula, but now proves to have a faint continuous spectrum, together with *bright* hydrogen lines, H_β, H_γ. H_δ, H_ϵ. $H\zeta$. The bright nebular line at 5007 is absent, so that this body more nearly resembles η Carinæ. The second object has the position R.A. = 18h. 39·3m., Decl. = − 33° 27′; formerly announced as being of Type V., it now proves to have the spectrum of a gaseous nebula.

COMET BROOKS (1889 V.), 1896.—The accuracy of the revised ephemeris of J. Bauschinger, noted in NATURE, August 13, has been confirmed by an observation of the comet made by H. Kobold, at Strasburg Observatory, on August 11 (*Ast. Nach.*, 3372, p. 206). He describes the comet as being feeble, and about 0·5′ of arc in diameter; in form round, with a small central condensation. The observation is considered fairly trustworthy. As the corrections the observer gives for reducing the positions stated in the ephemeris to those actually observed are only −0·49s. and −0·7″ in R.A. and Decl. respectively, the ephemeris will need no alteration for purposes of continued search.

CONTRIBUTIONS TO THE ANTHROPOLOGY OF BRITISH INDIA.

MR. EDGAR THURSTON, the energetic Superintendent of the Madras Government Museum, has recently turned his attention from zoology to anthropology, and in his fourth *Bulletin* has published the first of what we hope will be a series of investigations on the ethnography of the Madras Presidency. Thanks to the example set by Mr. Risley, the reproach of lack of interest in the natives of India on the part of residents is now being removed, and we hope that Mr. Thurston and others will continue this extremely important line of study. The title of the memoir is "Anthropology of the Todas and Kotas of the Nilgiri Hills; and of the Brahmans, Kammalans, Pallis, and Pariahs of Madras City." A large number of measurements are published, and the paper is illustrated with twenty-one plates, many of which are excellent.

One-half of the *Bulletin* deals with that very interesting autochthonous people, the Todas, who are nearly as hairy as the Ainu, and who likewise exhibit affinities with the Australians, although their high, straight nose, and fairly regular features, give them a more pleasing appearance than the latter. The typical Toda man is above medium height (5 ft. 6¾ in.), well-proportioned, and stalwart; he is dolichocephalic (73·3), with projecting superciliary ridges. A valuable account is given of the customs and religion of these herdsmen, which supplements previously published descriptions. Morality is reduced to a very low ebb before marriage, and truthfulness is not held in great regard. The Todas are endogamous as a tribe, and even as regards some of the five clans, intermarriage between the Paiki and Pekkan clans is said to be forbidden. The buffalo sacrifice is their only purely religious ceremony; it is supposed to bring good luck, and make the buffaloes yield abundant milk. A buffalo calf is killed by a blow on the head from a piece of sacred wood; the assembled Toda men (women are not permitted to take part in the ceremony) salute the dead animal by placing their foreheads on its head. According to Breeks, the flesh must be roasted on a fire made by rubbing two sticks together, and eaten by the celebrants. That is, the divine animal is periodically killed without shedding its blood, the flesh is not sodden by boiling, and the communicants eat their divinity for the benefit of the community: save on these occasions the Todas never eat meat. Mr. Thurston, however, was informed that the flesh is given to the Kotas.

The Kotas, who are allied to the Todas, are excellent artisans, being especially skilled as blacksmiths—they also pursue agriculture; but they are universally looked down on as being unclean feeders and carrion-eaters. Their diet evidently agrees with them, as they are a hard, sturdy set of men. Several of their customs are detailed. The Todas are slightly taller (1696 mm.) than the Kotas (1629 mm.), but they have the same weight (115 lbs.). They are also broader shouldered, and, though they do less manual work, their hand-grip is considerably greater. The cephalic measurements in both average about the same (length, 19·2 mm.; breadth, 14·2 mm.; index, 74).

The short account of the measurements of forty men of each of the four Bengal castes is suggestive. It is evident that the Brahmans are here a mixed Aryan and Dravidian people; below these are the Kammalans, or artisans; still lower are the Pallis, or agriculturists; and the lowest are the Pariahs; but there are traces that these once held a higher position. Risley found the nasal index coincided to a remarkable extent with the caste rank. And here we find the same story; for these four castes it is, respectively, 76·7, 77·3, 77·9, and 80; but the Pariahs are eclipsed by the Paniyans (95·1), about whom Mr. Thurston promises us further information. There is very little difference in height between the Brahmans (1625 mm.) and the Pariahs

(1621 mm.), but the Kammalans are shorter (1597 mm.). The Brahmans are better nourished, and have broader heads (142 mm.), the other three castes averaging 137 mm.; they also have the largest hands. Taking them all round, there is not that difference between the Brahmans and Pariahs that one might expect to find; but this can be explained by racial mixture. A. C. H.

SCIENTIFIC EDUCATION IN GERMANY AND ENGLAND.[1]

IN our frequent discussions on scientific education, we have both often been struck with some points of very great difference between the English and the German way of dealing with it. As it may be asserted without national arrogance that University education is in Germany in a more satisfactory condition than in your country, you are, of course, anxious to know which of the German customs I consider most effective in bringing about this better state of things; and I will, therefore, try to point them out. Of course, I shall confine myself to the subject of natural science, and especially chemistry and physics, feeling myself unable to deal with sciences beyond my knowledge. The main point of our system may be expressed in one word—freedom—freedom of teaching and freedom of learning. The first involves for the teacher the necessity of forming in his mind a clear conception of the scope of his science, for, as he is free to choose any possible method of view, he feels himself answerable for the particular one he has chosen. And in the same way the student feels himself responsible for the method and the subjects of his studies, inasmuch as he is free to choose any teacher and any subject. One who has not seen this system in action may be inclined to think that such a system must lead to arbitrary and irresponsible methods on the side of the teacher, and to confusion on the part of the student. But the former is avoided, because at the beginning of his career the teacher is dependent for his advancement on the results of his scientific views, and is naturally anxious to improve his position in the educational world. And as for the students, they themselves impose certain restrictions on their own freedom. Most of them feel that they require some advice and guidance, and they therefore follow the usual and approved order in conducting their studies. As to the inventive man of original ideas, it has often been proved that for him any way is almost as good as any other, for he is sure to do his best anywhere. Moreover, such a man very soon excites the interest of one of his teachers, and is personally led by him, generally to the great advantage of both.

Let me illustrate these general remarks by considering the course followed by an average chemist. In his first half-year he hears lectures on inorganic chemistry, physics, mineralogy, sometimes botany, and of late often differential calculus. Moreover, the German student is accustomed to take a more or less strong interest in general philosophy or history, and to add in his *Belegbuch* (list of lectures) to the above-named *Fachcollegien* (specialised studies) one or two lectures on philosophy, general or German history, or the like. Very often there are in the University one or more popular professors whose lectures are heard by students of all faculties without reference to their special studies. The student who has heard during his stay at the University only lectures belonging strictly to his *Fach*, is not well thought of, and is to some extent looked down on as a narrow specialist. But I must add that such views are not prevalent in all faculties, and there are some—*e.g.*, the faculty of law—whose students confine themselves, with few exceptions, to attending exclusively lectures in that faculty.

In the second half-year the chemical student begins with practical laboratory work. Notwithstanding the perfect freedom of the teachers, the system first introduced by Liebig into his laboratory at Giessen is still universally adopted in German universities and technical high schools—viz. qualitative and quantitative chemical analysis, the former conjoined with simple spectroscopic work, the latter amplified by volumetric analysis. This is followed by a course of chemical preparations, formerly chiefly inorganic, now chiefly organic. Even here, a regular system is being widely developed owing to the use of some well-known text-books. Of late years this course is followed in some laboratories by a series of exercises in physical chemistry and electro-chemistry.

While these practical exercises, which last for three or four half-years, are being carried out, the student completes his knowledge of physics, mathematics, and the other allied sciences by hearing lectures and working practically in the physical and often also in some other laboratory. The exercises done, he goes to the professor and asks him for a "theme" to begin his "work"—viz., his dissertation for the degree of Doctor of Philosophy. This is the most important moment in his life as a student, for it generally determines the special line of his future career. The "theme" is usually taken from the particular branch of the subject at which the professor himself is working; but, as the scientific name and position of the professor depends, not only on his own work, but to a large extent on the work issuing from his laboratory, he is careful not to limit himself to too narrow a range of his science.

Of course it is best of all if the student selects for himself a suitable "theme," suggested to him by his lectures or practical work, or from private study of the literature of the science. But this seldom happens, for the young student is not yet able to discern the bearing of special questions, and lacks knowledge how to work them out. Sometimes (but not very often, indeed) he points out to his professor in a general way the kind of problems he would like to work at, and the professor suggests to him a special problem out of this range of subjects. During the working out of his chosen subject the student learns generally much more than he has heard at lectures. Every part of the investigation forces him to revise the scientific foundations of the operations he performs. During this time the incidental short lectures given by the professor on his daily round from one to another of the advanced students are most effective in deepening and strengthening the student's knowledge. As these explanatory remarks are generally heard not only by the student whose work has caused them, but also by a number of fellow-students working near, a fairly wide range of scientific questions are dealt with in their hearing. Often these small lectures develop themselves into discussions, and, as for myself, I judge from the frequency of such discussions between the students whether the session will turn out a good one or not. If the professor thinks the work sufficiently complete to be used as a dissertation, the student proceeds to the close of his studies. He prepares himself for the examination, which is conducted by the very professors whose lectures he has heard and in whose laboratories he has worked. This examination varies somewhat in different universities, but in no case is it either very long or extensive; indeed, it is not considered as very important. For we are all aware what an uncertain means of determining a man's knowledge and capabilities an examination is, and how much its issue depends upon accidental circumstances. Part of this uncertainty is removed by the fact that the professor and the pupil know each other, are acquainted with one another's modes of expression and scientific views. The main purpose of the examination is to induce the student to widen his knowledge to a greater extent than is covered by the subject of his dissertation; but, indeed, it happens very seldom that a student whose work is considered sufficient does not pass the examination.

We have no great fear that this system may induce a professor to treat his own pupils in too lenient a way, and so lower the standard of the Doctor's degree. There was a time when such abuses used to occur, but there very soon arose such public indignation that the abuses ceased to occur. Even at the present day similar instances occasionally occur, but, as before remarked, the position of a professor depends in such a degree upon the value of the dissertations worked out under his supervision, that such deviations from the right way correct themselves in the course of time. The most effective instrument for that purpose is the publication of all dissertations and the consequent public control over them; for this reason publication is, I believe, compulsorily prescribed in all German universities.

When the student has finished his course he is still entirely free to choose between a scientific and a technical career. This is a very important point in our educational system; it is made possible by the circumstance that the occupation of a technical chemist in works is very often almost as scientific in its character as in a university laboratory. This is connected with a remarkable feature in the development of technical chemistry in Germany—the very point upon which the important position of chemical manufacture in this country depends. The organisation of the power of invention in manufactures and on a large

[1] A letter from Prof. W. Ostwald, communicated by Prof. W. Ramsay to the *Times*, August 25.

scale is, as far as I know, unique in the world's history, and it is the very marrow of our splendid development. Each large work has the greater part of its scientific staff—and there are often more than 100 *doctores phil.* in a single manufactory—occupied, not in the management of the manfacture, but in making inventions. The research laboratory in such a work is only different from one in a university by its being more splendidly and sumptuously fitted than the latter. I have heard from the business managers of such works that they have not unfrequently men who have worked for four years without practical success; but if they know them to possess ability they keep them notwithstanding, and in most cases with ultimate success sufficient to pay the expenses of the former resultless years.

It seems to me a point of the greatest importance that the conviction of the practical usefulness of a theoretical or purely scientific training is fully understood in Germany by the leaders of great manufactories. When, some years ago, I had occasion to preside at a meeting, consisting of about two-thirds practical men and one-third teachers, I was much surprised to observe the unhesitating belief of the former in the usefulness of entirely theoretical investigations. And I know a case where, quite recently, an "extraordinary" professor of a university has been offered a very large salary to induce him to enter a works, only for the purpose of undertaking researches regarding the practical use of some scientific methods which he had been working at with considerable success. No special instructions are given to him, for it is taken for granted that he himself will find the most promising methods; only, in order to increase his interest in the business, part of his remuneration has been made proportional to the commercial success of his future inventions. From this clear understanding of the commercial importance of science by the directors of industrial establishments there science itself gains another advantage. A scientific man can be almost sure, if he wants in his investigations the help of such technical means as only great works can afford, that he will get such assistance at once on application to any work; and the scientific papers of German chemists very often contain acknowledgments, with due thanks, of considerable help they have thus obtained.

Besides these advantages for the development of scientific and technical chemistry in Germany there exists another very important factor—practical assistance from the Government. Universities are in Germany affairs of the State, not of the Empire, and in no other point has the division of the Fatherland into many smaller countries proved itself to such a degree a boon and a blessing. The essential character of the German universities, the freedom conferred by the independence of the numerous universities, is never lost. There have been hard times occasionally for the universities of one country or another; but some universities were always to be found where even in times of hard oppression liberty of teaching and learning remained complete and unaffected, and the spirit of pure unalloyed scientific research was preserved and encouraged. So this palladium of intellectual freedom has never been lost; and it regained the former influence as soon as the casual oppression ceased. In our days there is among all the separate State Governments in Germany a clear conviction of the importance of practical support being given to pure scientific research. To take one instance, in order to facilitate teaching and research in electro-chemistry (a recently developed branch of science) a suggestion by some leading practical scientific men to the members of the Government was sufficient. Upon such a suggestion a considerable sum of money was spent first by the Prussian Government for the endowment of electro-chemical chairs and laboratories in the three "polytechnic" colleges of that country. A short time afterwards it was resolved to erect at one of the universities (Göttingen) an institute for physical chemistry, and especially electro-chemistry, in the shape of a building which has just been completed. At the same time, other German countries have begun to grant to their universities and technical colleges considerable sums of money for similar purposes, *e.g.* the Saxon Landtag alone has unanimously voted half a million marks (= £25,000) for the erection of a splendid laboratory for physical chemistry at Leipzig.

You will excuse my boasting about our German management of this most important question of scientific education. It is no blind admiration without criticism, for I know by practical experience the management in other countries, and I can compare them. And it is only for the sake of science itself that I write these lines. If they should help the spread of the conviction of the incomparable practical usefulness of every support given to pure science, together with the recognition of the fact that the latter can only grow in an atmosphere of liberty and confidence, I should regard it as tending towards the progress of science itself, and destined to exercise such an influence on scientific progress as may be compared with the discovery of the most remarkable scientific fact.

THE HOMOGENEITY OF ARGON AND OF HELIUM.[1]

THE question of the homogeneity of argon has been discussed by Lord Rayleigh and one of us in their memoir on Argon (*Phil. Trans.*, A, p. 236, 1895). But at that epoch the data were not sufficiently numerous to enable us to arrive at very definite conclusions. The discovery of helium and the analysis of its spectrum by Runge and Paschen (*Sitzungsberichte d. Akad. d. Wissenschaften*, pp. 639 and 759, Berlin, 1895) lead to the thought that this body may be a mixture of two gases.

To elucidate this question we submitted these two gases to a methodical diffusion, causing them to traverse a duct of porous pipe-clay submitted on one of its surfaces to the action of a vacuum. We satisfied ourselves that we might thus effect the separation of hydrogen and helium and that of oxygen and carbonic acid, and that, by measuring the rapidity of the descent of a column of mercury introduced in the circuit of the apparatus, it is possible to arrive at a good determination of the molecular weight of various gases. We have then tried to separate argon into two parts by a method analogous to the separation of liquids by fractionated distillation.

The quantity of argon was close upon 400 c.c. The gas was then treated in the manner shown in the following scheme:—

	More diffusible.			I.			Less diffusible.
	$\frac{1}{2}$	. . . .			. . . .	$\frac{1}{2}$	
II. {	$\frac{2}{3}$	. . . .	$\frac{1}{3}$	$\frac{1}{5}$	. . . .	$\frac{2}{3}$	}
	$\frac{1}{2}$	. . . .			. . . .	$\frac{1}{2}$	
III. {	$\frac{2}{3}$	. . . .	$\frac{1}{3}$	$\frac{1}{3}$	. . . .	$\frac{2}{3}$	}
	$\frac{1}{2}$	. . . .			. . . .	$\frac{1}{2}$	
IV.	$\frac{2}{3}$	. . . .	$\frac{1}{3}$	$\frac{1}{3}$	. . . .	$\frac{2}{3}$	
	$\frac{1}{2}$	. . . .			. . . .	$\frac{1}{2}$	

We determined the density of the two extreme portions, and found that the one which ought to be the lightest had the density (O = 10) of 19·93, and the heaviest of 20·01. The separation, if it takes place, is therefore minimal.

The same experiment executed with helium yielded other results. The density of the specimen which passed first was 1·874, and that of the gas remaining in the apparatus 2·133. A great number of fractionations did not change these figures; even the spectra of the two specimens were absolutely identical. Even the first bubbles of the lighter gas showed the same lines, with the same intensity, as the last bubbles which remained in the apparatus. There was no difference in fifty fractions.

Lord Rayleigh has had the kindness to measure the refraction of the two specimens of gas. Whilst the lighter gives the figure 0·1350 (atmospheric air = 1), the heavier had a refraction expressed by the figure 0·1524. Now these two numbers have a relation almost identical with the relation of the densities, for—

$$\frac{0·1350}{0·1524} = \frac{1·874}{2·110} \text{ in place of } \frac{1·874}{2·133}$$

Let us now consider what happens when we submit a mixture of the two gases to diffusion. Let us take, *e.g.*, a mixture of hydrogen with an excess of oxygen. After a sufficient number of operations we obtain pure oxygen on the one hand, and on the other a mixture of 1 part of hydrogen with 4 parts of oxygen. It will not be possible to separate this mixture into its constituents, on account of the equal diffusion of oxygen and hydrogen when thus mixed. The identity of the spectra of helium prevent us from deciding which is the pure gas and which is the mixture. Calculation establishes that if we suppose the heavier gas is a mixture, the density of the lighter, supposed pure, ought to be 1·58. Helium, lastly, if it consists of a mixture of two gases, is formed either of two gases of the densities

[1] A paper presented to the Paris Academy of Sciences on July 27, by Prof. W. Ramsay and Dr. J. Norman Collie. (Reprinted from the *Chemical News*.)

2·366 and 1·874, or two gases of the densities 2·133 and 1·580.

But although this explanation is the most suitable, there exists another which deserves our attention. The spectrum of these two fractions shows no difference. It is not probable that two gases exist the densities of which are so near each other. The different gases do not possess a refraction proportional to their densities. It seems to us that we might admit that we have effected a real separation of the light mols. from the heavy mols. The idea that all the mols. of a gas are homogeneous has never been submitted to the test of experiment. We do not know of any attempt at a separation of this kind of a gas regarded as homogeneous into two different parts. But our experiments show that this question deserves to be studied. If it can yield us similar results we must change our ideas on the nature of matter.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE Marquis of Bute has signified his intention of contributing £10,000 to the University of South Wales, to be applied for the purposes of technical education in Wales, the sum to be handed over to the authorities as soon as required. The Drapers' Company have also promised £10,000 towards the fund for providing new buildings, and the Government have promised £20,000 on condition that an equal amount is raised by public subscriptions.

APROPOS of the complaint from the *Local Government Journal* referred to last week, we see in the recent report of the Somerset County Council that "manual instruction in agricultural processes has made no progress." Though some successful classes in sheep-shearing, thatching, and hedging have been held at a few centres, Committees that have endeavoured to organise instruction of this kind report, as a general rule, that they have been unable to obtain from the farmers that support and co-operation which is indispensable if the work is to be carried out successfully.

WE notice in the report of the Technical Education Committee which was adopted by the Northumberland County Council at their recent meeting, that it has been decided to renew the grant of £500 to the Agricultural Department in the Durham College of Science on the following conditions, which differ somewhat from those which obtained last session:—The college is to undertake the direction of the school of agriculture and demonstration farm in accordance with the Technical Education Committee's requirements, as well as to arrange and supervise not less than six manurial trial stations at local centres in Northumberland, and to arrange for as many as sixty lectures, examinations, or inspections in agriculture and dairy work. On the other hand, the farm in Northumberland is to be open to the students of the Durham College of Science at times which are to be specified. This mutual arrangement should prove very beneficial.

THE East Sussex Committee for Technical Instruction complain that attention is given too exclusively to elementary science teaching in the various classes throughout their county, and that scarcely any work of an advanced character is attempted. This is bad, but it will be much worse if they attempt advanced teaching too soon. A completely new form of agricultural instruction has been undertaken by the authorities of the agricultural school at Uckfield, which is maintained by this Committee. The students are taken to many of the sales of agricultural implements and produce which occur in the neighbourhood, as well as to the fortnightly cattle auctions. The idea, which is to give the students an acquaintance with current values of farm and live stock, seems to have some good in it, though considerable discretion will have to be used by the instructors to prevent erroneous notions being imbibed by the students.

THE programme of the Princeton University sesqui-centennial celebration has just been announced as follows:—Tuesday, October 20, commemorative religious services in Marquand Chapel, discourse by President Patton; reception and introduction of delegates in Alexander Hall; probably a musical concert in Alexander Hall, not yet fully arranged, and some other suitable event may be substituted. Wednesday, October 21, Alumni Day, oration and poem in Alexander Hall, Prof. Woodrow Wilson, orator; Rev. Dr. Henry Van Dyke, poet; reception by President and Mrs. Patton at Prospect; students' torchlight procession and illumination of the campus; addresses from the steps of Nassau Hall, and student songs by alumni and undergraduates. Thursday, October 22, one hundred and fiftieth anniversary day; the sesqui-centennial celebration, academic procession marches to Alexander Hall; announcement of university title; announcement of endowment secured; conferring of honorary degrees, and other appropriate ceremonies; farewell dinner to the invited guests in Alexander Hall.

THERE are, it seems, only twelve scholars at the Swanley College in Kent, including six who hold scholarships which have just been awarded. Since the Kent County Council are bound to pay for twenty pupils as a minimum, the Technical Education Committee desire a more satisfactory state of things, and have recommended an entire reconstruction of the college. Nor is everything quite what is desired in Berkshire. The lectures for teachers provided by the education authority in this county cost £550 a year, yet it is reported that there is a want of appreciation of the value of the courses on the part of those for whom they are intended. Moreover, the object for which the lectures were instituted, viz. the provision of teachers to hold evening continuation schools, has not been attained. The Committee for Technical Instruction has therefore recommended that no new students be admitted for attendance at science lectures, but that the three years of existing students (if duly qualified) be completed. It is further complained that teachers have not availed themselves of the good work which is being done at the Reading University Extension College.

THE Programme of Technological Examinations of the City and Guilds of London Institute (Whittaker and Co.) furnishes abundant information on the valuable work which the Institute is doing for technology and manual training. The programme contains the syllabuses of the sixty-six subjects in which examinations are now held (a helpful list of works of reference being given at the end of each), and the examination questions set this year. Among the changes in the Institute's programme, we notice the following:—The subject of "Brickwork and Masonry" has been divided into two, "Brickwork" and "Masonry," and a practical examination, to be held in London, has been added to each. The regulations for the examination in "Photography" have been altered. In future, all candidates will be required to pass a local practical examination before being admitted to the written examination in the ordinary grade. The syllabus in "Paper Manufacture," in "Pottery and Porcelain," in "Boot and Shoe Manufacture," in "Dressing of Skins," in "Cotton Spinning," has been re-written. In several other subjects the syllabus has been altered. Provision has been made for admitting, under certain conditions, teachers of secondary schools to the manual training examinations.

THE report of the Somerset County Education Committee for the financial year ending March 31, 1896, gives abundant evidence of the accomplishment of much good work. The plans of the Committee are laid upon a carefully thought-out basis, and reflect no small credit on the wisdom of their organising adviser. These arrangements have been the same as in previous years, with the exception of discontinuing the courses of University Extension Science Lectures, which has meant a saving of more than £1000 per annum. We are glad to notice that the Committee are able to report that the work as a whole "shows a distinct and satisfactory tendency to develop along certain well-marked and permanent lines, with a corresponding reduction in the number of classes of a more or less ephemeral character." In no case has an evening continuation school been reported to them by the inspectors as generally inefficient; and "there is a general tendency towards an increase in the average attendances" in all of the 141 of these schools. As regards the work in the secondary schools of the county, many of which have been substantially aided by the Committee, it has been rightly laid down "that the best foundation for technical instruction is a really good secondary education sufficiently comprehensive in its character to include, in addition to the ordinary English subjects, natural science, mathematics, modern languages, drawing, and some manual training, and it is with a view to place an education of this kind at moderate fees within the reach of all in the county who wish to avail themselves of it, that the County Committee gives the aid specified." It is not to be wondered at, after so sensible a declaration, that the report is able to call attention to excellent results from all divisions of their administrative area.

SOCIETIES AND ACADEMIES.

LONDON.

Chemical Society, June 18.—Mr. A. G. Vernon Harcourt, President, in the chair.—The following papers were read :—The action of bromine on pinene with reference to the question of its constitution, by W. A. Tilden. The author experimentally confirms his view that one molecule of pinene can combine with four atoms of bromine, and proposes a new formula for the hydrocarbon.—Preliminary note on some products from pinene tetrabromide, by W. A. Tilden and A. Nicholls.—An apparatus for showing experiments with ozone, by G. S. Newth. The author describes an apparatus for showing the action of reagents on ozonised oxygen, the reagent being introduced in such a way that the volume of the gas is not disturbed.—Note on santalal and some of its derivatives, by A. C. Chapman and H. E. Burgess. It is shown that cedrene and the hydrocarbon obtained by the action of phosphorus pentoxide on santalal are very similar but not identical.—Second note on the liberation of chlorine during the heating of a mixture of potassic chlorate and manganic peroxide, by H. McLeod. The author confirms his previous observation that the gas obtained by heating potassium chlorate with manganese dioxide contains small quantities of chlorine, but no ozone.—Polymorphism as an explanation of the thermochemical peculiarities of chloral and bromal hydrates, by W. J. Pope. The fact that the heat of dissolution of chloral hydrate is partly dependent on the length of time elapsing since solidification, is shown to be due to a change in crystalline form of the solid substance.—Explosion and detection of acetylene in air, by F. Clowes. Mixtures of air with 3—81 per cent. of acetylene are explosive ; the best method of estimating acetylene in air is based on the examination of the change occurring in a hydrogen flame when such air is passed over it.—On the occurrence of quercitin in the outer skins of the bulb of the onion (*Allium Cepa*), by A. G. Perkin and J. J. Hummel. The colouring matter present in the skin of the onion bulb is shown to be quercitin.—On the colouring matter contained in the bark of *Myrica nagi*, by A. G. Perkin and J. J. Hummel. The bark of *Myrica nagi* contains a colouring matter $C_{15}H_{10}O_8$, which the authors term myricetin ; it is probably a hydroxyquercitin.—Preliminary note on a new base derived from camphoroxime, by M. O. Forster. By treatment with methylic iodide, camphoroxime yields campholenonitrile together with the hydriodide of a new tertiary base, $C_{12}H_{19}N$; a number of compounds of the latter have been prepared.—The rotation of aspartic acid, by B. M. C. Marshall.—Synthesis of pentacarbon rings. Part iii. Condensation of benzil with lævulic acid, by F. R. Japp and T. S. Murray. Benzil and lævulic acid condense yielding two isomeric anhydrobenzillævulic or diphenylhydroxycyclopentenonylacetic acids ; the derivatives and decomposition products of these acids are described.—Absorption of dilute acids by silk, by J. Walker and J. R. Appleyard.—Position-isomerism and optical activity ; the methylic and ethylic salts of ortho-, meta-, and para-ditoluyltartaric acid, by P. Frankland and F. M. Wharton.—Double sulphides of gold and other metals, or the action at a red heat of sulphur upon gold when alloyed with other metals, by J. S. Maclaurin.—The relative weights of gold and silver dissolved by potassium cyanide solutions from alloys of these metals, by J. S. Maclaurin.—The three chlorobenzeneazosalicylic acids, by J. T. Hewitt and H. E. Stevenson. Ortho- and para-chlorobenzeneazosalicylic acids have been prepared by the action of diazotised chloraniline solution on salicylic acid ; derivatives and salts of the three isomerides are described.—Condensation of chloral with resorcinol, by J. T. Hewitt and F. G. Pope. The condensation of chloral and resorcinol yields a tetrahydroxydiphenylacetic acid and its lactone.—The atomic weight of Japanese tellurium, by Masumi Chikashigé. The tellurium of which the atomic weight has previously been determined has been obtained from metallic tellurides ; if tellurium be a compound, as has been suggested, that obtained from Japanese tellurosulphur should have a different atomic weight. The author finds, however, that tellurium from the latter source has the same atomic weight as that prepared from tellurides, and consequently concludes that this element really has a greater atomic weight than iodine.—Derivatives of camphene sulphonic acids, by A. Lapworth and F. S. Kipping. The α- and β-chlorocamphenesulphonic chlorides obtained during the sulphonation of camphor, and their derivatives, are described.—Iodoso- and iodoxybenzaldehydes, by V. Meyer and T. S. Patterson.—α-Isopropylglutaric acid, by W. H. Perkin, jun.—The action of ethylic β-iodopropionate on the sodium derivative of ethylic isopropylmalonate, by T. Z. Heinke and W. H. Perkin, jun.—The condensation of halogen derivatives of fatty ethereal salts with ketones and ketonic acids, by W. H. Perkin, Jun., and T. F. Thorpe.—The electrolysis of the salts of monhydroxy-acids, by J. W. Walker.—The action of formic aldehyde on phenylhydrazine, and on some hydrazones, by J. W. Walker.—The colouring matter of Sicilian sumach, *Rhus coriariæ*, by A. G. Perkin and G. Y. Allen. The colouring matter of Sicilian sumach is not quercitin or quercitrin, but myricetin.—The colouring matter of *Querbracho Colorado*, by A. G. Perkin and O. Gunnell. The colouring matter of querbracho is fisetin.—On asitine, the alkaloïd of *Aconitum heterophyllum*, by H. A. D. Jowett. Asitine is amorphous and non-toxic, and probably has the composition $C_{22}H_{31}NO_2$; many of its salts are described.—The action of methyl alcohol on aconitine. Formation of methyl benzaconine, by W. R. Dunstan, T. Tickle, and D. H. Jackson.—The chemical inactivity of Röntgen rays, by H. B. Dixon and H. B. Baker. The authors have investigated, with negative results, the question whether Röntgen rays are able to influence chemical change, either by starting it or by accelerating or diminishing it after it has been started by ordinary light.—Colloïdal chromsulphuric acid, by H. T. Calvert and T. Ewan.

BOOKS RECEIVED.

BOOKS.—The Theory of National and International Bibliography : F. Campbell (Library Bureau).—Forty-third Report of the Department of Science and Art (Eyre).—Durham College of Science, Calendar for Session 1896-7 (Reid).—Sixteenth Annual Report of the U.S Geological Survey, Parts 2, 3, 4 (Washington).—The Boston Machinist : W. S. Fitzgerald, 4th edition (Chapman).—Steel : W. Metcalf (Chapman).—A Guide to Chamonix, &c. : E. Whymper (Murray).—Accounts of Trade carried by Rail and River in India, 1894-5, &c. (Calcutta).—City and Guilds of London Institute, Programme of Technological Examinations, Session 1896-7 (Whittaker).—Signaletic Instructions, including the Theory and Practice of Anthropometrical Identification : A. Bertillon, translated (Paul)—The Indigenous Drugs of India : K. L. Dey, 2nd edition (Thacker).—Lehrbuch der Experimental Physik : Prof. E. Riecke, Zweiter Band (Leipzig, Veit).

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