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THURSDAY, SEPTEMBER 1, 1870

THE MEDICAL SCHOOLS OF ENGLAND AND GERMANY

I.

IN the region of scientific medicine the Germans enjoy at the present time an undisputed pre-eminence. Their medical books have taken possession of the markets of the world, and their larger schools are themselves like markets in which representatives of all countries appear, in order to exchange gold for the higher culture. Next to German books, those published in Great Britain have the best programme and apparently the widest geographical distribution. But here the enormous territory of the English language plays a very prominent part. To professional men who do not speak the English tongue, English books are but little known and still less read. In like manner, the extent to which foreigners avail themselves of the English schools is exceedingly small. It is very significant that even Americans pass by their natural market, England namely, for the acquisition of higher medical education, and resort annually in troops to Germany, where they have to contend with the disadvantage of a foreign language.

If we now attempt to ascertain the causes of this phenomenon, we must arrive at once at the conclusion that local conditions have nothing to do with it. Great Britain can number nearly as many medical schools as exist in Germany, and their local position is extremely favourable for visits from foreigners. In this respect the larger cities enjoy an enormous advantage over smaller towns, for medical students do not, as a rule, despise good living, and therefore prefer to live in great cities. Hence the medical schools of Vienna and Berlin are rendezvous for travelling physicians, while many a small German town with no less distinguished a teaching power, is visited only by those foreigners who prefer to taste the treasures of a teacher drop by drop, far from the battle of the metropolis. London alone possesses eleven medical schools. Here are also offered to the travelling disciple of science the advantages of the metropolis, and something besides which can only be obtained on the Continent by an expenditure of time and money, and then not altogether, the opportunity, namely, of changing the school, and especially of discovering the one which it will best answer his purpose to visit.

If, in spite of all this, the schools of London form no open market, the cause must be sought for in their quality. It does not, in fact, require much criticism to discover that the construction of the medical schools here is so entirely different from that of the corresponding schools in Germany, that the defectiveness of our language is the only excuse for designating the two by the same name. In the majority of the medical schools of London instruction is only a subsidiary product of the general charity. The hospitals are supported by voluntary contributions, and at one and the same time medical assistance is given to the sick and medical instruction to youths eager for knowledge. The subscribers elect officers for this purpose; and both the electors and the elected are agreed in considering the treatment of the sick as the primary office, instruction as a secondary office. Professional men on the Continent are obliged to bear this relationship constantly in mind, if they would understand how it comes to pass that a nation of such sound judgment in practical life as the English, can act in a manner which, to those who look at such hospitals from the stand-point of the development of science, appears so opposed to every modern theory of work.

In these hospitals, founded and supported by voluntary contributions, the teachers, in the course of their lives, change several times the subject of their lectures. The teacher generally begins with botany, and abandons it after he has acquired a moderate knowledge by several years' instruction, in order to take up another important branch of human knowledge; and perhaps again exchanges this for something else, just at the time when he can say with Faust:—

> Und sehe dass wir nichts wissen können.

The final object of such a course is the position of hospital physician or surgeon, with which, as a rule, a profitable practice is also combined. The hospitals attain in this manner the best result which they can attain. They obtain physicians who for several years have given their attention more or less assiduously to reading scientific literature. In so far as these physicians are at the same time in a wider sense useful to the community, this system performs good service in educating a large number of well-read medical men. For the development of these officers into distinguished original investigators, the mosaic-work of their course of study is altogether destructive. From the haste with which they rush through great departments of knowledge, they can give no time or leisure to assist in drawing up the endless chain of causes to the light of day. Such an undertaking, moreover, is entirely outside the aim for which the charitable contributions were given.

Among the numerous London schools, some three or four stand out conspicuously, and one of these is so constituted, from its connection with other non-medical chairs, as well as from the history of its establishment, that one may conclude the fostering of science is not in this case a secondary aim. Let us observe now what assistance is afforded by this school for this purpose; and let us compare these means with those provided by a great German school, for instance, that of Vienna. The writer of this article has chosen this example, chiefly because he is familiar with the interior arrangements of the Vienna school. The consideration also that this is the oldest of the prominent German schools, and that its eventful history can exhibit many points of interest which stand prominently forward, has its influence. Other examples might be brought forward which would equally illustrate the contrast.

It must, in the first place, be borne in mind that the London school just referred to, that of University College, is, like all her sisters, a private institution, while the Vienna Medical School is a State institution; the Government builds or rents the building, directs it, and provides it with officers. The means for this object flow from the provisions of the budget of the Ministry for Public Instruction; and the Government therefore possesses the power of granting the means of diminishing or enlarging them according to circumstances. Since many German schools, which are still State institutions, are yet entirely or partially self-supported, some words of criticism must be devoted to this system. The independent means of the Universities are not only means for the protection of their independence, but at the same time are a bulwark against the attacks of an absolute Government, hostile to science. In those states, however, where a protection against violence is provided by distinct legislation, and especially in those in which the people has a share in the Government, every other bulwark than that which the law offers is only antiquated trumpery; the independent foundations of the Universities are no better than a means for the maintenance of the spirit of caste, and for the fostering of nepotism. In Austria the independent foundations of the Universities have fallen a prey to the insatiability of the State treasury. The freedom which has so rapidly developed itself in Austria during the last few years, found the doors of the Universities open, and forthwith established herself there. Well might their noble spirit be envied by those institutions which have used their independent means for enclosing the school and the church within a common wall!

It will not require many words to prove that the state institution enjoys an advantageous position with respect to the private institution. For while, on the one hand, the State can calculate on future revenues in laying out money for the establishment of scientific institutions, the private institution must regulate itself in accordance with its actual means, and can only reckon upon much narrower materials and temporary factors. This contrast cannot be illustrated in a more striking manner than by comparing the palace which the Saxon Government has built in Leipzig for instruction in physiology, with the one or two rooms which University College, London, is able to devote to the same purpose.

It must, however, not be forgotten that it is only recently that such institutions as that at Leipzig have been established. There are, indeed, at the present moment, only three other institutions in Germany which can be compared to it, viz., the Physiological Institute at Breslau, the splendid Anatomical Institute at Berlin, and the Pathological Institute at Vienna, all of which occupy separate spacious buildings. In these and other universities, establishments of a similar kind, and on a similar scale of completeness, are either projected or are now in course of construction.

S. STRICKER

THE EARLY HISTORY OF MANKIND

Researches into the Early History of Mankind and the Development of Civilisation. By Edward B. Tylor. Second Edition. (London: Murray, 1870.)

MR. TYLOR has devoted himself to a branch of Anthropology of which there are very few students in this country, that namely which treats of the mental development of man as elucidated by his arts and customs, and especially by his myths, his superstitions, and his language. More than a third of this volume is devoted to an elaborate account of the gesture-language used by deaf mutes and savages, and to picture-writing, word-writing, and the influence of names and images, as illustrative of various phases in the development of the human mind. After this we have chapters on the growth and decline of culture, as illustrated by the use of stone implements of various degrees of perfection, by weapons, by modes of procuring fire, and by modifications in various domestic utensils. Then follow accounts of remarkable savage customs, such as the curing of disease by the extraction of foreign substances from the body of the patient, the prohibition of marriage with certain relations or namesakes, tabooing the names, and even avoiding the sight, of certain relations, and the extraordinary custom of the *couvade*. Myths, their origin and geographical distribution, are then discussed; and these varied subjects are all treated from a twofold point of view, either as giving us an insight into the laws of the development of the human mind and the growth of civilisation, or as furnishing, by their similarity over extensive areas and in widely separated countries, an argument for the common origin of the different races of man.

The work is throughout carefully written, and is illustrated by abundance of curious and little-known facts and a critical examination of their bearings. The author is very cautious in drawing any general conclusions, and when he does so carefully indicates all sources of error and uncertainty. The character of such a book cannot be fairly shown by extracts; we shall, therefore, briefly summarise one or two of the more interesting subjects and arguments.

Many persons are, no doubt, under the impression that the deaf and dumb talk to each other by means of the finger alphabet; but the use of this pre-supposes a knowledge of the meaning of words and letters, which the deaf and dumb child can hardly be taught till intelligible communication has been established with it. Alphabetical speech is slow and clumsy, whereas the deaf mute speaks to his comrades as rapidly, if not as precisely, as we do by means of vocal speech. He uses a copious and expressive language of signs, indicating words and ideas by means of simple motions and gestures. This language has the advantage of being natural and universal. English, French, and German children to a great extent understand each other, and even a North American Indian would be able to talk with them all, it being a curious fact that many of the signs used by the Indian tribes are identical with those of the deaf and dumb schools of Europe; and Mr. Tylor states that a Sandwich islander and a Chinese both made themselves understood in an American deaf and dumb institution. The "gesture language" is also connected with spoken language in two remarkable ways. Among low savage tribes there are cases in which speech has to be supplemented by gesture to make it intelligible, and it is, perhaps, reasonable to suppose that at an earlier stage of civilisation the proportion of gestures to words would be greater than it is now. There is also an agreement in some fundamental idioms. In the Aryan languages many substantives have verbal roots descriptive of some of their essential attributes. "Thus, the horse is the *neigher;* stone is what *stands*, is *stable;* water is that which *waves, undulates;* the mouse is the *stealer;* and age is what *goes on*, the oar is what *makes to go;* the serpent is the *creeper;* and so on." Now the deaf and dumb who have no means of communication but by signs, express themselves in the same way. To them the bird is what *flies*, the fish what *swims*, the plant what *sprouts out of the earth*, &c., and the motions of flying, swimming, and sprouting up, are used as the signs for bird, fish, and plant.

Mr. Tylor is usually very cautious in concluding that any art or custom found among distant peoples has had a common origin, or can be used to measure the comparative antiquity of the migrations of races. Yet, in one case, in which he considers that it can be so used, he arrives at conclusions which hardly seem warranted by the facts. The Madagascans smelt iron, as do also the natives of Africa and of the western islands of the Malay Archipelago, but the bellows used in Madagascar is the peculiar Malay form—an upright bamboo, with piston formed of a bunch of feathers, and entirely different rom the inflated skin-bellows of Africa. This curious fact, taken in conjunction with many others, and with the presence of a considerable Malay element in the Malagasi language, as well as some physical resemblance between the Hovas and Malays, conclusively proves that there has been a Malay immigration to Madagascar, and also that it took place subsequent to the introduction of the art of working iron. So far the facts lead us safely; but Mr. Tylor, if we understand him rightly, goes further than this, and holds it to be proved that the art of smelting iron was first introduced from Malaisia rather than from Africa, and also that the Malay migration to Madagascar was a much later event than the Malay migration to Poynesia, where the use of iron was unknown till introduced by Europeans. Now, for all that the facts tell us, iron working may have been known in Madagascar before the Malays came, they merely introducing the bamboo bellows, which would be especially adapted to a country in which bamboos were abundant, but cattle, deer, and all large animals which could furnish suitable skins, *entirely absent*. They certainly might have introduced iron-working also, but the fact of their introducing a more useful form of bellows does not prove it. So, with regard to Polynesia, there are two sufficient reasons why iron-working should not have been introduced there, even if the Malay immigration had been long subsequent to that which invaded Madagascar. The only Malay iron-smelters are certain tribes of Borneo, Sumatra, and the Malay peninsula, while among the Javanese and Coast Malays who are the chief navigators, as well as among the whole of the Moluccan tribes, the art is entirely unknown. But the Malay element in the Polynesian languages is composed of pure Malay and Javanese words, and there is every reason to believe that wandering traders of these nations introduced the Malay language into Polynesia. Added to this the fact that the volcanic and coralline islands of the Pacific contain no iron ore, and we need not wonder at iron workers not being found among them, or that the tribes who still more recently peopled New Zealand should not know how to make use of the iron ore that occurs there. The evidence of language on the other hand would seem to be in favour of the Madagascar migration being the most ancient, because the Malay and Javanese words are generally more changed in the Malagasi than in the Polynesian languages. In the latter, scores of words are slightly modified but intelligible Malay, as *pua* for *bua* (fruit), *ika* for *ikan* (fish), while in the former many equally common words have been greatly altered, as *ravina* for *ron*, Jav. (leaf), *lanitra* for *langit* (sky); and the word *lima* or *rima* (five), which extends almost unchanged over the whole of Polynesia, becomes the hardly recognisable *dimi* in Malagasi. The Hovas are undoubtedly much nearer the true Malays in both physical and mental characteristics, than are the Maories or Tahitians, and this would indicate that a larger and more compact body had reached Madagascar than Polynesia. This is what we might expect, for the chances are so much against a safe canoe voyage across the open Indian Ocean, a distance of nearly 3,000 miles with scarcely an intervening island, that we can hardly suppose it to have occurred more than once; while the numerous islands in every part of the Pacific render it much more probable that canoes accidentally blown out of their course from the Moluccas or New Guinea, might repeatedly reach some islands tenanted by the Polynesian race. But a compact body which ultimately conquered much of the country and established a dominant race, would have a greater tendency to preserve their language unchanged; and the fact that so much change has taken place is an additional argument for the comparative antiquity of the Madagascar immigration. The ignorance of making pottery in Polynesia, an art which has certainly been known to the Malays and Javanese from a very early period, seems at first sight opposed to the theory of a late communication; but this fact may, I think, be easily understood when we consider that the immigrants were most probably traders, and of the male sex, and therefore ignorant of an art which in their native country is almost entirely practised by women. While treating of this subject, Mr. Tylor falls into some confusion by speaking of the "Malayo-Polynesian culture," and "the pure Malayo-Polynesian race," things which can have no existence, if, as I believe, Malays and Polynesians are almost as distinct as Malays and Africans.

The geographical distribution of customs, beliefs, and myths, furnishes our author with materials for some of his most curious and interesting chapters; but, still less than the arts of savage life, do they appear to afford any safe ground for conclusions as to the affinities or early migrations of the races of mankind. We cannot conclude without expressing our admiration of Mr. Tylor's industry and research in so little trodden and comparatively unproductive a field. He has carefully brought together a vast number of interesting phenomena illustrative of the mental condition of savage man, but we cannot help feeling that a satisfactory explanation of them has not yet been arrived at, and that we require researches of a very different nature before we can form any adequate conception of the various causes that have influenced the early mental development of the human race.

A. R. WALLACE

KARL KOCH ON TREE-CULTIVATION

Dendrologie: Bäume, Sträucher und Halbsträucher, welche in Mittel- und Nord-Europa im Freien kultivirt werden. By Prof. Karl Koch. 8vo. Vol. I. 735 pp., without illustrations. (Erlangen: F. Enke, 1869. London: Asher and Co.; Williams and Norgate.)

THE work of Prof. Karl Koch is a valuable addition to the literature of applied Botany; and no doubt throughout German-speaking countries it must early become the volume of all others most redolent of Nicotian essence on the shelves of people who concern themselves about tree-cultivation and general nursery-work. It has a considerable value, too, as a contribution to Scientific Botany, for its author has had long experience, with very favourable opportunities, in connection with everything woody,* hardy enough to bear exposure in the open air in Prussia. He is a good botanist and an enthusiast in his speciality, so that his book includes much useful information, especially of that kind, too seldom put on record, possessed by workers in the open air, or so scattered through periodical botanical and gardening literature, as to be hardly available at a pinch. To English botanists and nursery-folk it offers many interesting features. One amongst many others is the opportunity it affords of comparing the climatic differences between Britain and Central Europe, as deducible from the copious data which the "Dendrology" gives relating to the capacity of the various species to resist the severity of continental winters.

Here is an example of the author's plan of treatment. We take the common Aucuba, or so-called "variegated laurel," of every English shrubbery. *Aukuba*, not *Aucuba* Prof. Koch says it must stand :—

A. Japonica, Thunb. Fl. Japon. 64, tab. 11 and 13 (1784).

THE JAPANESE AUKUBA.

Japan.
Flowers in May and June.
Leaves varying in form, mostly elliptical or elongate-lanceolate, usually sharply toothed above the lower third, glabrous: inflorescence with appressed hairs; petals ovate-lanceolate, dark brown-red; berries coral-red.

One of the most beautiful of evergreen shrubs, unfortunately scarcely hardy in north-eastern Germany, even when protected in winter, though thriving in the open air in France and Rhine-land. In England it is a prime favourite.

Then follows a general account of the habit of the plant.

Until quite recently we have had only the bright-yellow-spotted female shrub in our gardens, but since Von Siebold and Fortune have introduced the unspotted male plant, and a number of new forms, *Aukuba japonica* promises to compete with the Holly in variety. In the last catalogue (1867) of the Siebold-Garden, Witte has published no fewer than twenty-four forms as already in the trade.

Here are enumerated some of the more important of these, arranged according (1) to form of leaf, (2) kind or mode of variegation, and (3) toothing of the leaf-margin.

Altogether more than a page is devoted to this *Aucuba*. To its less-known Himalayan congener, *A. himalaica*, about half as much. The common Barberry extends over nearly five pages, but it is an extreme case of a variable and much-cultivated plant.

Throughout the plan is pretty much the same as is followed in *Aucuba*. After the name follows synonymy so far as may be needed; then frequently some explanation of the origin of the name, whether generic or specific, often including a biographical paragraph in the case of plants commemorating some person. Then follows the geographical distribution of the species. Here we may remark, what this book is especially apt to recall, the curious fact familiar to every botanist, how many well-known species of tree and shrub, even such as are not likely to have undergone material modification under culture, are of doubtful origin,—the horse-chestnut and walnut for example. Persia and the Central Asiatic plateau generally are credited with these trees, and probably the guess is in the right direction, though no wild specimens exist of either species in our herbaria.

There are some things we cannot agree with in the book, of course. For example, we should not undo *Cratægus*, and make all our thorns into medlars (*Mespilus*); nor do we consider the reasons given suffice to justify a renaming of our common lime-trees (*Tilia*); but these are matters too technical for discussion here, and after all of subordinate importance.

The first volume only, including the Polypetalous Natural Orders, is as yet published. Just at present German gardens are left pretty much to take care of themselves, and we fear there is no chance of the second volume until we have this miserable war settled. D. OLIVER

* Down indeed to *Alyssum saxatile* and *Iberis saxatilis*.

OUR BOOK SHELF

Travels of a Naturalist in Japan and Manchuria. By Arthur Adams, F.L.S., Staff-Surgeon R.N. (London: Hurst and Blackett, 1870.)

THOSE who wish to see what a world of pleasure may be opened up to one by an adequate knowledge of some department of Natural Science, ought to read this book. Mr. Adams is an enthusiastic naturalist, with a special "weakness," as he terms it, for insects, and the delight he has experienced in the hunt for specimens, and the close observation of his favourites in different parts of the world, have been simply endless. We should hope that some of his readers will find his eagerness "catching," and be led to feel new interest in objects which they have hitherto regarded with indifference, or perhaps treated as a nuisance. Among other animals observed by Mr. Adams with more or less care, was one of two specimens of the scaly ant-eater (*Manis Javanica*)—a female—which came under his notice. During the day she remained coiled up in a ball, but grew lively as night approached. In walking "she trod gingerly on the bent under-claws of her fore-feet, and more firmly on the palms of her hind-feet." One of her favourite attitudes was that of her gigantic extinct analogue, the Mylodon, as seen in the model of Waterhouse Hawkins in the gardens of the Crystal Palace. Supported on her hind limbs and "the firm, flattened, powerful, muscular tail," she would raise her fore-feet, moving her head and body from side to side, and peering cautiously about with her "little round prominent eyes." On the least alarm she tucked in her head between her fore legs. On one occasion she was coiled up in a strong net and supposed to be properly secured; when night approached, however, she easily burst her trammels, and was discovered by the violent barking of a little dog who was puzzled and alarmed by the apparition of so strange a visitor. Both specimens were fed on raw eggs and chopped raw beef, and seemed to thrive. Besides observations of this sort, Mr. Adams's readers will find scattered throughout his work some pleasant sketches of natural scenery, a few descriptions of amusing personal adventures, and occasional glimpses into the different customs of the countries he has visited.

Echinides du Départemente de la Sarthe considérés au point de Vue zoologique et stratigraphique. Par MM. Cotteau et Triger. Avec 65 planches de fossiles, dessinées et lithographiées d'après nature par MM. Levasseur et Humbert, 10 planches de coupes géologiques, et 2 tableaux. Williams and Norgate, 1855—1869.)

NOTHING can afford better evidence of the zeal and assiduity with which palæontology is now pursued than the fact mentioned by M. Cotteau in the preface to this work, that whereas MM. Agassiz and Desor, in their

Catalogue raisonné of 1845, indicated the number of Echinidæ discovered in the department of Sarthe at forty-one, and D'Orbigny in his Prodrome Stratigraphique at forty-four, the result of the joint labours of the authors, and other naturalists of the district, has raised the number to no less than two hundred and two. The discrimination, description, and illustration of the different species have been performed by M. Cotteau, whilst their stratigraphical arrangement and position have been accomplished by M. Triger. Some of the more remarkable forms discovered by them are the large *Heterocidaris trigeri*, with its peculiar arrangement of tubercles and its singular ambulacral pores, a species of which has recently been obtained by Mr. Wright from the inferior oolite of Yorkshire; the *Metaporhinus sarthacensis*, a curious and exceptional form representing in the Jurassic series the great family of *Spatangidæ*, which only make their appearance at the commencement of the cretaceous period; the *Echinocyphus tenui striatus*, which the authors are inclined to regard as the type of a new genus; the *Cidaris vendocinensis*, which presents such beauty of form and markings, with many others we have no space to particularise. The lithographic drawings are clearly drawn, and comprehend all the species discovered.

Progress of Chemistry. Jahresbericht über die Fortschritte der Chemie und verwandter Theile anderer Wissenschaften. Unter Mitwirkung von Th. Engelbach, Al. Naumann, W. Städel; herausgegeben von A. Strecker. Für 1868. 2tes Heft. (Williams and Norgate, 1870.)

THIS part, like the first, which we noticed a short time since, contains 480 pages; Organic Chemistry, continued from the first part, occupies 354, 13 of which are devoted to Animal Chemistry. Analysis fills 71 pages, the remainder being set apart for Technical Chemistry.

The section on Organic Chemistry contains accounts of Perkin's investigations on the hydrides of sodium and benzyl-salicyl, on butyric coumarin, and butyrocumaric acid, as well as Fittig's criticism of Perkin's views of the constitution of coumarin, which has since given rise to a lively discussion. Notices of Schützenberger's researches on triacetiodol, and of those of Perkin and Duppa on the constitution of glyoxylic acid are given. Stenhouse's experiments on benzol sulphuric acid are described, besides several papers by different chemists on the sulpho acids of the benzol series. Hofmann contributes, as usual, several valuable papers, the most important being those on the cyanide of naphthyl and its derivatives, and on the artificial mustard oils containing the radicals ethyl, methyl, amyl, tolyl, and benzyl, in the place of the allyl existing in the natural essence. The constitution of these compounds is also discussed. Gautier's researches on the carbylamines are continued, and also those of Lossen on hydroxylamine, which are noticed at considerable length. The action on organic bases is concluded by an account of Crum Brown and Fraser's experiments on the physiological effects of the compounds produced by the union of methylic iodide with the poisonous alkaloids.

Under Analysis we find the methods proposed by Frankland and Armstrong for the examination of potable waters, and which have since given rise to some controversy. Russell's apparatus for gas analysis is also described. The section on technical chemistry (only a portion of which appears in this part), contains papers by Rosenstiehl and Kopp, and by Schaffner on the preparation of sulphur from alkali waste, a subject of much importance, especially in this country, where the heaps of residues, which usually evolve sulphuretted hydrogen, and often pollute rivers in their neighbourhood, accumulate in immense quantities; this material, thanks to the study of scientific chemistry, may now be made to yield pure sulphur to such an extent as to make it worth the while of the manufacturer to extract it, while its removal renders the residues innocuous.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his Correspondents. No notice is taken of anonymous communications.*]

The Gulf-Stream

I SEND for the perusal of your readers an extract from a note sent to me by Mr. King Groom of Stornoway. The facts he mentioned may be interesting. The beans I have received. When I was in the Hebrides some time since, I was assured that clubs, paddles, and drinking vessels of wood were sometimes found on the shores of the islands, and that these things were supposed to float in the Gulf-Stream from Mexico, but I never saw any. Some of your readers will doubtless be able to say where these beans grow, and to give their opinion as to the probability of their floating from the Mexican Coast, or from some other tropical country or island whose shores are washed by the Gulf-Stream. If these beans are brought over by the Gulf-Stream, it is probable that they may also be found on the west coast of Ireland and on the coasts of Devon and Cornwall. If so it would be interesting to hear from your correspondents in those parts whether any particular virtue is attributed to them by the inhabitants.

Board of Trade, Aug. 25. THOMAS GRAY

"Upon travelling on the shore of Illery I found a, to me, curious bean, known as '*dolichos mens*,' or horse-eye bean. I was told that every year a few are found along the shores of the Outer Hebrides, and they are supposed to be carried by the Gulf-Stream from the Gulf of Mexico. These beans are much sought after, as they are superstitiously supposed by the South Uist and Barra people to be a charm in child-bearing; if at that time the woman has one in her hand she will have little pain in her labour. I was much interested in the story as told me by a Mr. Arbuckle, at Barra, the parish schoolmaster, and confirmed by Dr. M'Donald of North Uist. It is said the curious have a small band of silver wire placed round the bean that has travelled so far of itself, and a silver cross put on the side by a silversmith in the south. The inhabitants state they are sure the bean is brought to the shore of the Gulf-Stream from Mexico, as they have been thus found from time immemorial. Another bean is also brought by the same means—viz., 'Eig autea Mi: Mosa,' a large brown seed."

The British Medical Association

THE reference to the income and expenditure of the British Medical Association last week requires correction. The income of the association, from subscription, is not 5,000*l.* but 3,471*l.*; the subscription annually only one guinea. The association is one which includes an important political and social organisation. For the annual guinea the associates are enabled not only to supply themselves with a journal weekly, which stands on the same footing as those published at a higher price than their total annual subscription, but in addition they keep also an active and important organisation, with branches in every part of the kingdom, which protects medical and public interests and advances medical science. Many think with you that it would be desirable to make larger grants for special researches. But for this purpose it would be necessary to start a special fund. The annual mass of scientific matter published in the journal is treble what could be contained in any volume of Transactions, and has the advantage of being published at the opportune moments of discussion. You would confer a benefit by urging the propriety of a special fund for original research. But the members are so well pleased with the large return for their annual guinea, that their numbers have risen in four years from two to four thousand; and the weekly journal, which now takes the lead in periodical medical literature, is the essential condition of the political and professional authority of the association. To publish in its place an annual volume of Transactions would, it is universally felt, be a suicidal act of retrogression. Among the 4,000 members there are not a dozen who are not aware of this. X.

The Intended Engineering College

"Look not a gift horse in the mouth"

I WAS very sorry to see in NATURE for 18th August a letter from Mr. G. C. Foster complaining of a supposed intention of the Government to aid the teaching of science, and basing this complaint upon what appears to me most narrow and unreasonable grounds. The representatives of science have been tolerably unanimous in demanding of the Government further aid to science, and I think they should with equal unanimity protest against any such grumbling at a promised instalment before its nature and conditions are known.

Mr. Foster says "that it is fair to assume that Government," &c., &c., and then having stated the details of his assumption, proceeds to criticise it. I think (and surely shall not be alone in this opinion) that it is most unfair to assume anything of the kind as the basis of criticism. When the details of the Government scheme appear, will be the proper time to discuss them.

Being as ignorant of these details as Mr. Foster appears to be, I can say nothing about them, but must protest against the principle upon which Mr. Foster's complaint is based. It is this, that Government must initiate no scientific effort, give no special aid or patronage to any college or scientific institution, lest it should assail the vested interests of "institutions like University College and King's College in London, and Owens College in Manchester." According to this shopkeeping view of the interests of these institutions, they themselves should never have come into existence, and all endowments or other extraneous aids to new institutions must be regarded as attacks upon the vested interests of their more venerable competitors.

In the classic period when Munro Primus, Munro Secundus, and Munro Tertius occupied successively the anatomical chair of the University of Edinburgh, its medical school was the most flourishing in Great Britain; students journeyed from London and all parts of England to attend its classes. At about the culminating period of its rising fame the London University was founded, and among its most active promoters were Lord Brougham and other Scotchmen. According to Mr. Foster, these Scotchmen were traitors to their own University, for undoubtedly the medical schools of University College, King's College, and the provincial colleges affiliated to the London University, have, by the competition of their metropolitan *prestige*, patronage, endowments, and local facilities, seriously rivalled their northern predecessor; and if the University of Edinburgh were merely established for the purpose of providing class-fees for its professors, the Scotch promoters of the London University were traitors to their own *alma mater*; but if the objects of the Edinburgh University are the promotion of science and diffusion of general knowledge, then the founders of the London University were co-operating with the Edinburgh University, even though they thinned the attendance in some of its class-rooms.

The other institution whose vested interests Mr. Foster specially pleads to conserve, should rather be suppressed, if his principle were accepted, for by its rich endowment and *prestige*. Owens College competes unfairly with the less-favoured institutions of Manchester and the private science teachers there who have no share in its endowments. Mr. Oliver Mason is about to build and endow with princely munificence a great educational establishment in Birmingham, and has bought the ground within a stone's throw of the Birmingham and Midland Institute. If the council and friends of the Midland Institute accepted Mr. Foster's views, they would denounce Mr. Mason's project as the founding of an opposition shop, which, by its rich endowment, might undersell their own and take away their customers. If they regarded the existing institute as merely established and maintained for the purpose of providing certain professors with their present moderate salaries, for supporting a secretary and his assistant, and for the comfortable maintenance of the porter and his wife, they might consistently do so; but speaking from direct personal knowledge, I can affirm that, on the contrary, they of all others are the most rejoiced by Mr. Mason's munificence, because they are the most deeply interested in the intellectual progress of their town. I recommend Mr. Foster to imbibe some of their spirit, and to rest assured that no revolutionary disturbances are likely to result from excessive endowment or patronage of scientific institutions, either by the present or any other British Government of this generation. Even if Mr. Lowe's next financial surprise should consist in devoting a portion of the national surplus to the elevation of the national intellect, let generous acceptance accompany our amazement.

W. MATTIEU WILLIAMS

Scientific Research

DURING the last century every branch of scientific research has undergone gigantic strides towards perfection. Great credit is due, ay, even in greater proportions than is given, to those talented minds, who, although on every hand impeded by obstacles, have successfully overcome every difficulty, and solved problems which excite the wonder and admiration of the universe. Within the limits in which I am compelled to restrain myself, it will not be necessary to pursue my idea with elaborate detail; but if I generalise with sufficient skill, abler hands can take up the thread and unwind it to the extremest minutiæ.

The means required for the prosecution of scientific research in a systematic manner, have never been at all adequate to the requirements. Various branches of science, such for example as astronomy, chemistry, &c., require an immense outlay in order to enable the philosopher to pursue his investigations with any prospects of a successful result. Others again, such as botany, geology, &c., require the devotion of long periods of time for the collection of specimens and their classification. Our societies certainly have, by their energy and emulative inducements, succeeded in extending scientific research far beyond the point which the most sanguine mind desired a century ago. But might not these societies be made much more useful; would it not be possible to distribute more widely their published transactions? Many gentlemen who take a great interest in scientific questions, but who do not live in London, are prevented from joining the societies by their exclusiveness. To them the valuable libraries, the periodical meetings, are useless, they therefore do not subscribe, and the high price of the publications prevents many from becoming purchasers. It seems to have become a settled opinion amongst scientific bodies, that everybody is able to spend 1*l.*, or even more, just when he pleases, upon a luxury.

Unconnected with any society—not because of their own wish, but from their misfortune—hundreds of steadfast, able minds are working, adding, or being forestalled in, as the case may be, their mite here and there, in the onward march of progress. It is by unknown, frequently penniless searches after truth, that the great and complex problems have been solved. These great minds exist among us still. As examples, let me cite one or two instances, before suggesting an idea whereby we might hear more of such people. Whilst residing at Oxford, I became acquainted with a policeman, W. S., whose geological collection and information would have been worthy of one of our greatest and richest savants. A young gentleman, now a dissenting minister, and an undergraduate of that excellent institution, the London University, collected and classified some hundred species of the flora of his native county, Yorkshire. A third gentleman is assiduous in his botanical researches, and has, I believe, collected and classified the whole of the flora of another county. Now, it is such minds as these that, judiciously directed, make the greatest discoveries. Their only incentive to labour is a fixed inherent desire to know more of certain things; they have really no aim but the satisfying of the natural tendency to move in this direction. The published text-books upon various scientific subjects are not adapted for self-taught students, the authors presuppose the aid of a master. There is no meeting together to discuss what this or that one has done, but each laboriously pursues his own path, often wasting valuable time in going over ground already fully explored.

I would suggest that local societies in connection with the central bodies, be formed in *every* county. The nucleus to these bodies already exists in clergymen, doctors, solicitors, and above all, tutors and schoolmasters. There is a yearning amongst many of these men for more information, and, as previously stated, they are debarred from reaping any benefits from the central bodies as conducted at the present moment. The government of these branches should be somewhat similar to that of the older societies; each member ought to contribute an annual subscription, in return for which he would receive—

α. Free admission to all meetings of the local and of the central society.

β. The transactions of the society also free.

γ. Any other benefits as the committee might determine, or which could be obtained.

Thus far the scheme I advocate is simple, but it may be said, this necessitates the formation of as many branches as there are societies. Not so, however; the country members within each district would be too few to allow of this; but they might *all* congregate under one roof, be subject to one government, and reap the advantages of communion. Every member might upon election signify the particular transactions he wished to obtain; his subscription, after deducting a certain per-centage for local expenses, could be sent to the society publishing them, and he should be enrolled upon its books as a *bonâ fide* member. The information to be obtained of one science is generally so closely connected with another, or others, that no difficulty would be found in getting the greater part of the local members together for the purpose of hearing an address upon any scientific subject. The large libraries of the various central societies could be utilised by sending a parcel of books to the local library, such books to be exchanged monthly. It may be asked, would the parent bodies, and science generally, gain by such an arrangement? Are the British Islands too well explored? Is there no more celestial or terrestrial object remaining unknown? Have mathematicians, mechanicians, &c., reached the bounds of their studies? I say to these, and a score of other similar questions, No! Then the watchword should be Onward. By the above means the face of the whole country would be covered by earnest and interested searchers. Botanists might discover new species; astronomers would be joined into an immense circle, closely watching every phenomenon which occurred in the heavens; one statement would be verified by others; geologists would be at the side of every quarry or well, seeking specimens; antiquaries would be at hand to receive "finds," whenever historical ground or old buildings were being moved. Monthly statements of work performed would be forwarded to the general Secretary, to be printed in the Transactions. Lectures would be multiplied a hundredfold. Book-worms would find treasures hitting about in family mansions, and even in village cottages, which would satisfy even their craving appetite. But I am not writing for readers unable to understand. All will admit the feasibility of the plan, if only it were tried. Probably other correspondents may wish to be heard upon the subject, therefore I leave the suggestion in their hands.

Reading C. H. W. BIGGS

Kant's Transcendental Distinction between Sensibility and Understanding

As Dr. Ingleby's letter cannot well be answered, except by me, will you kindly insert the following observations? I am very sorry the form of the controversy compels me to refer to myself; you will see that the point at issue concerns an important question in Kant's philosophy. He said a certain question of mine was badly worded. As a question set out of a prescribed book, he concedes it to have been accurate enough, but he still denies the precision of the statement in that book. I think he is right, and that I was guilty of an error, though by no means so grave an error as he imputes to me. But his imputation is again partly my fault, for I did not write clearly enough. Here are the words which misled him; "we must not confuse the empirical distinction between real object and merely subjective appearance with the transcendental distinction on which Kant's doctrine of Space and Time is based."

In the first place I do not think there is any ambiguity in the term *real object*, when I am speaking of an *empirical distinction*, for then it cannot possibly be a noumenon; and the meaning of *subjective appearance* follows upon its correlative. Dr. Ingleby should, therefore, have found no difficulty in interpreting me rightly so far, and, indeed, he has done so. But he understands the rest of the sentence as if I had written "we must not confuse the empirical distinction between real object and merely subjective appearance with the transcendental distinction *between the same two things* on which Kant's doctrine of Space and Time is based." This I did not say, though I am afraid my words are open to such a construction. He justly adds that Kant's Æsthetic is founded on no such distinction, and he points out the fact that Kant has in the previous page (p. 78 of Hartenstein's Ed.) spoken of his broad distinction in kind between Sensibility and Understanding, as a transcendental distinction.

I perfectly agree with him that this was the point referred to by Kant, and perhaps he is right that the philosopher meant nothing more. But what I had in my head when I wrote the passage, was a special phase or aspect of this same distinction, the aspect which insists, that *it is not merely the ordinary empirical sensibility* (such as tastes and odours), *but the a priori and necessary sensibility which his doctrine contrasts with the understanding.* Of course he has not yet considered, and therefore leaves undetermined, whether the understanding can cognize things, *per se*: but as to sensibility, the most obvious illustration which a superficial teacher would select, in expounding the so-called subjectivity of space and time, would be contingent, as opposed to necessary, data of sense. He would show how colour and taste and warmth were apparently perceived in the object; but were really modifications of the subject, while other qualities (extension, figure, &c.), were really necessary to the object. Kant protests repeatedly against this empirical distinction being used to illustrate his doctrine, which depends on a transcendental distinction—a distinction (I thought) not of mere contingent, but of pure *a priori*, and therefore necessary, sensibility from understanding. The passages which I indicated and translated in the sequel of the note, preach this peculiar aspect of his doctrine, and were cited for this reason alone.

I confess I was led to search them out by overlooking, stupidly enough, his employment of the phrase "transcendental distinction" in the previous page; and the fact, that Professor K. Fischer had omitted to mention so important a point, made me all the more anxious to notice it. But when my language was so ambiguous as to mislead a really competent critic, like Dr. Ingleby, I must only acknowledge my fault, and promise to make amends in my next edition. I trust, however, that in this instance, your readers will absolve me from having blundered in the principles of the Critical Philosophy, even if I gave too much meaning to the *transcendental distinction*. I cannot conclude without thanking your able correspondent for his valuable criticism.

Trinity College, Dublin, Aug. 15 J. P. MAHAFFY

Colour Blindness

To the remarks in Mr. Hayward's letter in NATURE of August 18, may I add my own observations? I have often noticed that my right eye has much greater defining power than my left; as, for instance, in reading print; but when I look at a check pattern of white and black, the white looks much whiter and the black much blacker to my left than to my right eye. Is not this somewhat analogous to Mr. Hayward's case?

St. Peter's, York, Aug. 20 LEONARD MARSHALL

Cross Fertilisation

THERE could perhaps be found no more striking illustration of the law which seems to demand, from all species of living things, frequent crossing as a condition of their continued existence, than is afforded in the structure and development of the flowers of *Lobelia*. A hasty examination of a few specimens of this plant might seem to refute this idea; and I can imagine an anti-Darwinian, unacquainted with the life-history of the flower, pointing triumphantly to it, not only as an instance of pepetual self-fertilisation, but also as an incontrovertible example of an organism specially adapted to the use and convenience of a different species, without itself deriving any advantage from the circumstance. For while the flowers of this genus are furnished with a broad and brilliantly-coloured lip, forming an attractive lure on which insects may alight to feed on the nectar provided for them, the introrse anthers are connected together, so as to form a rigid case completely enclosing the style and imbedding its summit in pollen. In this case, then, insect agency appears to be worse than useless; for though a few grains of pollen may be, and are, shaken out, through a small orifice between the extremities of the anthers, upon the back of every moderate-sized insect which enters the flower; such grains can apparently never be brought into contact with the stigma, and consequently must perish and be wasted. How completely, however, would such a reasoner find the tables turned by more continued observation. *Lobelia* is one of those genera which might be more correctly described as *versisexual* than, as strictly speaking, hermaphrodite. Its flowers are at first entirely male, the female organs not being fully developed till after all the pollen has been removed. Then the style forces its way between the extremities of the anthers, and expands into a broad stigma, so situated as to rub the backs of the bees and other insects that enter the flower, and brush off any pollen that they may bring. Thus, self-fertilisation, instead of being, as it at first seemed, inevitable, is in fact impossible; and insect agency, which appeared at best useless, is absolutely necessary to the survival of the species.

"Versisexuality" seems also to be the rule among the species of *Ranunculaceæ*, *Geraniaceæ*, *Saxifragaceæ*, and probably many other families. It is evident that in such species the pollen of the earliest and the ovules of the latest flowers will be wasted; and since natural selection tends always to prevent any waste, it is conceivable that such species might in the course of many generations give rise to monœcious or diœcious descendants.

Kilderry, Co. Donegal W. E. HART

The "English Cyclopædia"

In answer to Nemo's letter in your issue of August 11, I do not wish to prolong the correspondence. An index will be added as soon as possible to the Natural History Supplement, in which cross references will be given. I am not the editor of the "English Cyclopædia," but I was

EDITOR NATURAL HISTORY SUPPLEMENT

Holly-berries obnoxious to Birds

Allow me to thank Mr. Hart for his remarks on my note, with reference to this subject; and, at the same time endeavour, as briefly as possible, to explain my meaning more fully.

I take it that a holly-tree, standing in a favourable situation for the growth of young plants, and bearing its berries until perfectly ripe (and I noticed a tree loaded with berries on August 1st), would stand a better chance of propagating and increasing that variety than a tree which has been robbed of all its berries by birds during the preceding winter. I am quite aware that the local distribution of some plants is, in a great measure dependent on birds; but, with regard to holly-berries so disseminated by the migratory thrushes, &c., the great majority would be deposited on arable or pasture land, where the young plants would be speedily eradicated by the plough or scythe, and consequently the parent tree would stand a worse chance of propagating itself from seed, than the variety from which the berries had fallen on ground adapted to their growth. Perhaps Mr. Hart will kindly point out where this hypothesis is "so different" from the theory of Messrs. Darwin and Wallace; a theory with which I, as well as most working zoologists, entirely agree.

East Woodhay, Aug. 8 HENRY REEKS

Solar Spots

I extract the following from Nature of 28th July, p. 267:—"Mr. T. W. Backhouse, of Sunderland, reports that in May there was a remarkable case of a Solar Spot making a revolution round another. It occurred with respect to the two largest spots of a group which was half way across the northern zone, on May 9th. The smaller spot was south of the larger on the 7th at 3^h, but preceded it on the 12th at 21^h, the line joining the two spots having rotated through an angle of 80° or 90° in $5\frac{3}{4}$ days."

It is interesting to observe that the direction of this rotation, from south to east, is the same as that in which cyclones rotate in the earth's northern hemisphere; in the southern hemisphere they rotate in the opposite direction. This coincidence gives some support to the theory of the solar spots being produced by cyclones. JOSEPH JOHN MURPHY

Old Forge, Dunmurry, Co. Antrim, Aug. 6

Noises Caused by Fish

Your issues for May 12 and 19, 1870 contain sundry notices of noises supposed to be produced at sea by various fish. The localities are mostly tropical. But it is not necessary to go so far afield for examples of the noises in question. While on board a steamer at anchor for two or three days in the Tagus off Lisbon in the spring of 1869 (April), I heard noises of the kind referred to, which were attributed by the ship's officers to a fish (whose name I now forget), the sound being produced, it was asserted, only at particular states of the tide. Disposed to consider the explanation a mere sailor's "yarn," or superstition, I did not give to the subject the attention it may have deserved.

Perth W. LAUDER LINDSAY

The Kingfisher's Meal

Returning from my morning's round on a pleasant summer's day, I observed a kingfisher perched on a hazel bough close to a pretty little trout-stream; my attention was instantly aroused, for one does not often see these pretty creatures, even during prolonged country excursions, in such a position; and moreover his attitude was peculiar—perfect stillness, with an inclination of the head to the left pinion—just the posture in fact that I have seen a fatally wounded bird take previous to dropping from its resting-place; indeed so close was the resemblance that I expected every moment to see the bird I was watching drop into the water, believing it to have been wounded; guess my astonishment when the supposed invalid was seen to dart with amazing swiftness into the curling stream, rise, and continue its rapid flight without apparent interruption, to the rails surrounding a hay-stack close by, where I saw it making most energetic movements of the head and neck, and first became aware, from observing a silvery, glittering, and writhing little fish in its beak, that, instead of being ill as I supposed, and suddenly determined on trying the effects of a bath, he was actually at dinner. After gorging this lively mouthful, the active and dexterous little fisher-bird returned to his hazel bough looking quite as invalidish as before; but now I was aware of his intentions. "Natura est dux optima." PHILALETHEIAN

Ancient Egyptian Forests

A note in the *Academy* for July speaks of ancient forests now turned to chalcedony, *e.g.* at Cairo, thus indicating a profuse vegetation in former days.

Let it not be forgotten that the hieroglyphs represent Egypt as the "land of trees," Khem having been the god of gardens. On the Rosetta stone Egypt is indicated by "a tree and the sign of land" (*vide* Wilkinson's Ancient Egyptians, ii., 184-7). It seems that the destruction of trees is an unvarying accompaniment of dense population. A. HALL

Poisoning by Œnanthe crocata

In your comments on the rapidly fatal poisoning case, recorded by me, where a man and cart-horse quickly died after eating a small portion of the roots of this plant, you remark "it seems strange that the horse, as well as the man, should not have rejected a plant of so acrid and suspicious a flavour." Now the flavour of the *root* of this plant is known to be mild and pleasant, and not acrid. I can confirm the truth of its mild taste from experience, as I have twice eaten portions of the root for experiment: the taste is intermediate between that of a turnip and the stalk of celery. The poison did not act as an irritant, but the deaths resulted from paralysis of the heart.

WORTHINGTON G. SMITH

BARON HUGEL

The death is announced of Baron Charles Hügel, well known as a scientific explorer and a cultivated man of letters. He was born 25th April, 1796, and, after completing his education at Heidelberg, was for some time engaged in the wars in the early part of this century between Prussia and France, and in 1814 he took part in the triumphal entry into Paris. In 1824 he relinquished military pursuits, and returning to Vienna, entered with great earnestness into the study of Natural Science, for which he had always shown a decided taste. For many years he studied assiduously, preparing himself for an expedition he had planned round the world. In 1831, on the 2nd of May, he set sail from Toulon, and was away six years. His ship was fitted out with every appliance for a scientific voyage, and in all the various localities he visited in Asia, Africa, and the then unknown field of Australia, he amassed large and valuable collections. These were, on his return, purchased by the Austrian Government, and to them the Vienna Museum owes its great importance, especially in the botanical treasures he had so lavishly accumulated.

The materials he brought back with him, and the abundant notes he had taken, were utilised in several elaborate scientific publications, such as Endlicher's "Plants of the Swan River District (Australia)," and Heckel's "Fishes of Cashmere."

The baron also delivered two learned and interesting addresses to the meeting of German Naturalists in 1838 and 1843, and besides these he sent many valuable scientific papers, especially on botany, to the Vienna scientific publications.

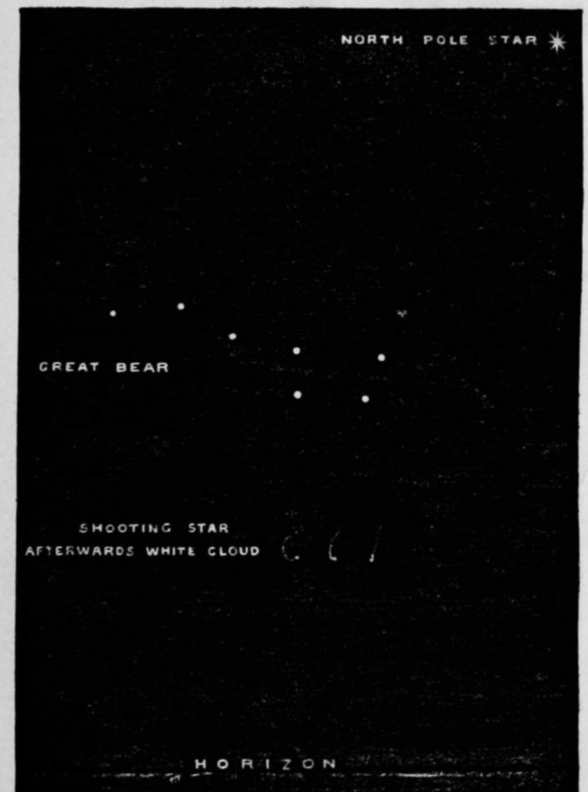
He is also the author of two works in German, "The Basin of Cabul" (Vienna, 1851), and "Cashmere and the Empire of the Sikhs" (Stuttgardt, 1840).

For many years he continued to take a very active part in all the scientific progress of his native country and of Italy. At the time of his death, in his seventy-fifth year, he was Austrian Minister at Brussels.

THE METEOR OF AUGUST 15

We have received descriptions from several correspondents of the remarkable meteor seen on the evening of August 15 over the north of England and Ireland and south of Scotland, to which we referred in our last number.

A correspondent from Portrush sends the following description and sketch :—" At 8.50, on August 15, when stars of first magnitude were only faintly visible, a shooting star was seen in the north-west. I have shown its position in the heavens in the accompanying sketch. It was observed to leave behind it a white thin cloud which

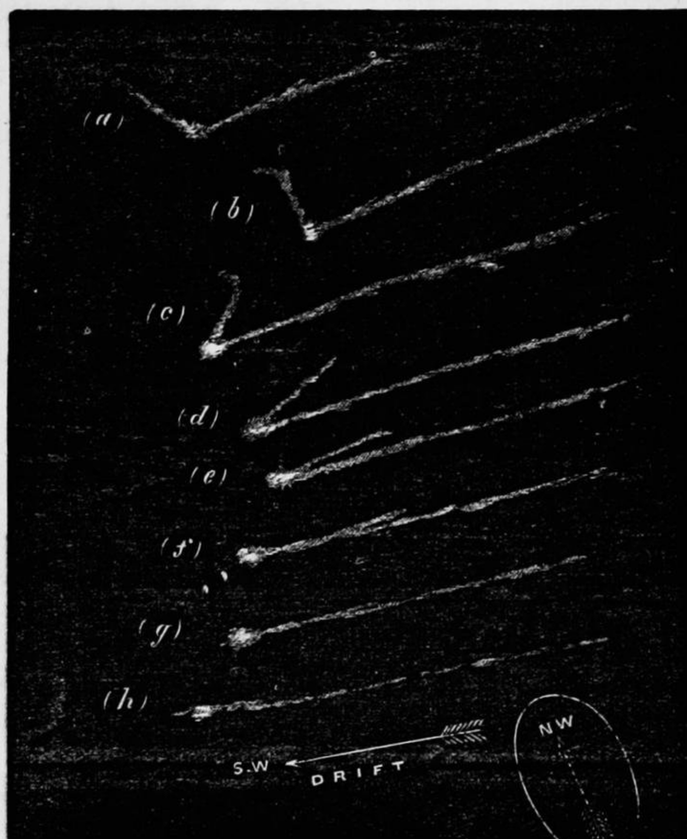


Shooting star, 8.50 P.M., August 15.—N.N.W. 25 deg. above the horizon, left behind it a streak of white cloud, which was clearly visible for ten minutes, drifting with the wind.

drifted a little to the west, and altered its shape from a straight line to a crescent. It was evidently illuminated by the light of the setting sun, and disappeared gradually in ten or fifteen minutes. Was the white thin streak of cloud, vapour, or dust? I observe by the newspaper that this cloud was seen in the neighbourhood of Belfast some forty miles distant, from which I infer that the phenomenon took place at a considerable altitude."

At Dunbar it is described by an observer in the following language :—" A remarkable atmospheric phenomenon was witnessed at Dunbar on Monday night. The phenomenon was first seen about a quarter before nine o'clock, and at that time it was more than half-way up the northern horizon. When first observed it had the appearance of a ball eight or ten inches in diameter, of a bright sparkling white colour tinged with blue, hanging suspended in mid-air. The colour, indeed, throughout was much the same as that of a star of the first magnitude. From the head or ball there issued a tail of the same bright colour, apparently three or four yards in length, and pointing in a north-easterly direction. By-and-by, however, a second tail seemed to branch off from the middle of the first one, at an angle of forty-five degrees, thus giving to the tail of the figure a cleft or forked appearance. This second tail seemed to come and go, being occasionally detached for a few seconds, sometimes indeed being lost sight of altogether, then suddenly coming into view, and appearing to unite again. The phenomenon lasted with little variation for fully twenty minutes, and then proceeded very slowly in a south-westerly direction."

At Kirkbank, near Burntisland, it presented the following appearance :—" A brilliant shooting-star appeared in the north-west on a bright evening sky, and darted out of sight northwards. Its path was precisely that of a body obliquely reflected from an air-cushion. It left a trail like a nebulous haze. At the point of reflection a vivid spot remained, and fainter trails before and behind ; corresponding to head or ball and tails noticed at Dunbar. The nucleus drifted towards south-west, and the branches gradually folded together behind, all disappearing as a



faint streak. Duration estimated fully ten minutes, terminating about 9.5 P.M., as Dunbar notice has it." The successive aspects were sketched by the writer and annexed.

And at Arran the appearance presented appears to have been very similar :—" On Monday night about half-past nine o'clock, there was a peculiar manifestation of what appeared to be electrical agency in the sky, at Whiting Bay. At that hour a bright light was seen to flash out from the north-west, near the horizon. It suddenly spread upwards in the form of a long ribbon, the upper half of which afterwards doubled down, when the whole assumed a horse-shoe form, and then gradually faded away. The sky was at the time perfectly clear, and a number of stars were visible, but the brightness of the meteoric appearance completely outshone them."

We should be glad to receive further descriptions of this remarkable meteor from some of our astronomical correspondents.

SCIENCE OF WAR

II.

MACHINE GUNS

THE Machine Gun has for a good many years, in one form or another, excited the attention of the military authorities of Europe and America, and recent events have made it the subject of a great deal of popular interest. The best known guns of this class are the Gatling Battery and the Mitrailleur. The first (of which Figs. 1 and 2, taken from photographs of the original in the possession of the British Government, present a front and rear view) is an American invention, and did good service on many occasions during the late civil war. Three sizes of this gun are constructed. The smallest has ten steel rifled barrels, the calibre being suited to the musket cartridges

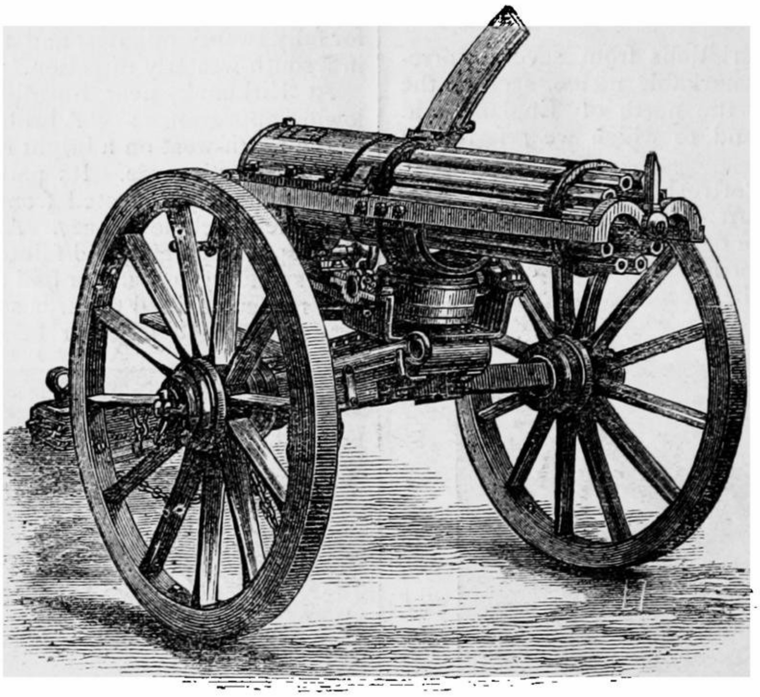


Fig. 1.

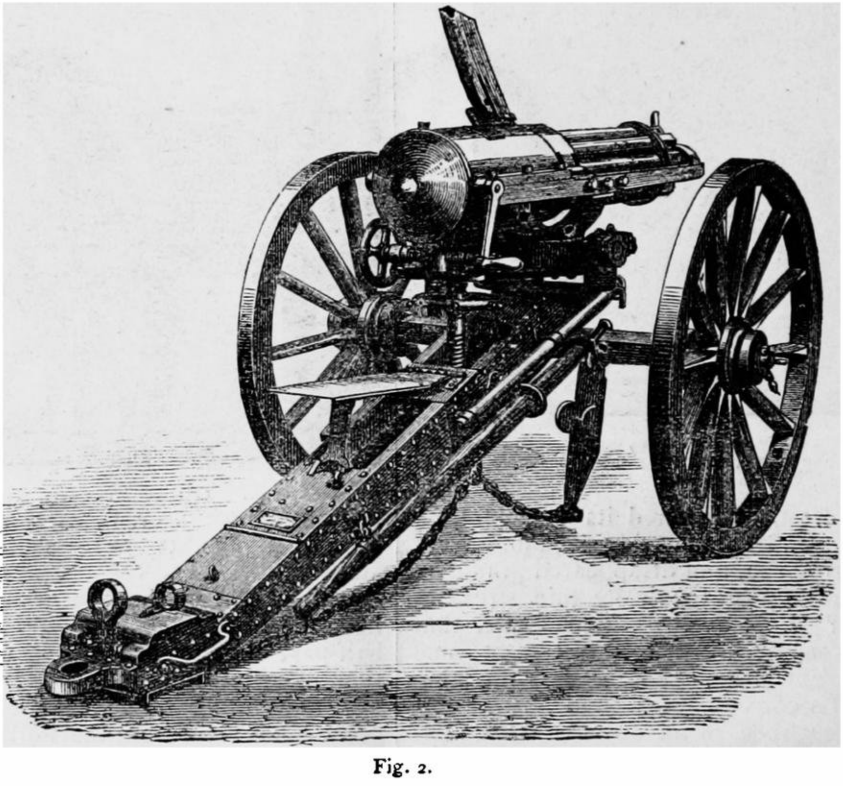


Fig. 2.

used by different Governments. The second-sized gun is constructed with the same number of barrels, but is invariably of three-fourths inch calibre, and discharges solid lead balls of $4\frac{1}{2}$ oz. in weight. The largest sized gun, which is of one inch calibre, has sometimes ten, but generally six barrels. It is provided with solid lead balls half-a-pound in weight, and can also use explosive projectiles. One of the main features of the gun is that it has as many locks as barrels, each barrel and its lock revolving together. Its success, therefore, as a whole, does not depend upon that of each of its parts, for if any of the barrels or their locks are injured, the remaining ones continue to work as well as ever. The weapon is supplied with cartridges by means of "feed-cases," through the hopper—the upward projection rising at the end of the breech-covering nearest the barrels. When it is in operation the cartridges are placed in the rear ends of the barrels, and the breech is closed at the time of each discharge by a forward motion of the locks. A return movement extracts the shells when the cartridges have been fired. In the ten-barrelled gun five cartridges are being loaded and fired whilst as many shells are in different stages of being extracted. The locks are not attached to any part of the gun, and operate on a line with the axes of the barrels. Whilst the gun is revolving, "they play," to quote the words of the manufacturers, "back and forth in the cavities in which they work, like a weaver's shuttle, performing their functions of loading and firing by their impingement on stationary inclined planes or spiral projecting surfaces." The weapon can be loaded and fired only when the barrels, inner breech, locks, &c., are being revolved, all of which operations are set going by a man simply turning the crank. In the most recent guns the covering and back diaphragm in the outer casing are perforated, the apertures being closed by

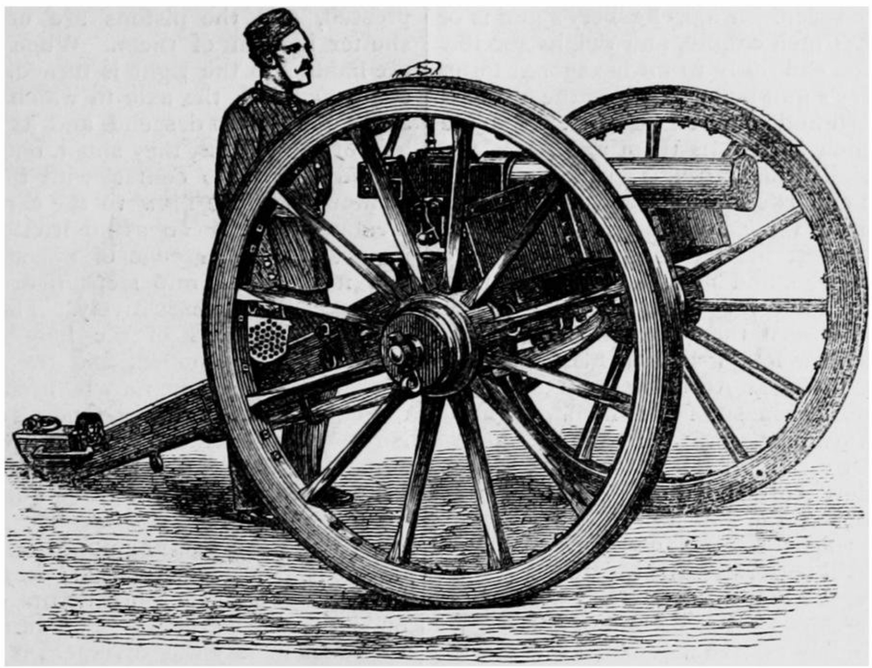


Fig. 3.

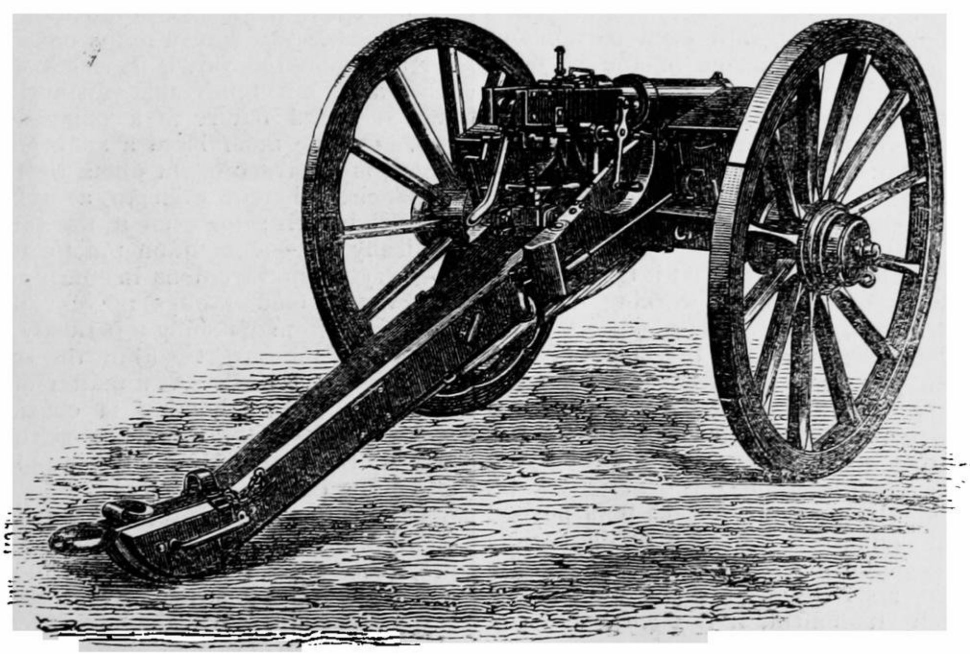


Fig. 4

means of a single removable plug. In this way the locks may be inserted and removed without taking off the caseable plate, obviously a great improvement, as it renders the inspection and repairing of the locks much simpler. The newest guns are also cocked by means of a knob placed at a point on the right side of the weapon. When turned, this knob permits the gun to be revolved without being snapped while not in use. If its position is reversed, the gun can be made to snap or fire at once. The carriage on which the gun is mounted is so constructed that the latter may receive, when being fired, a lateral motion, "so as to sweep the sector of a circle of more than twelve degrees, without moving the wheels or the trail of the carriage." Five hundred yards or more may thus be covered without the continuous fire of the gun being interrupted.

We turn now to the Mitrailleur Gun, of which there are two kinds, the French Mitrailleur and the Belgian, that of Montigny. The gun of which in Figs. 3 and 4 (also taken from photographs of the original) we present views from different points, is that which is at present being made the subject of a great variety of experiments at Shoeburyness. It was constructed under the superintendence of Major Fosbery, and, although improved in detail, in all essential points resembles the Montigny gun. It is the latter that we shall describe in what follows, making free use of the careful report on the subject presented by Major Fosbery about two years ago to the Government.

Like the Gatling gun, the Montigny Mitrailleur is made of three sizes, the smallest containing nineteen guns and the largest thirty-seven. Major Fosbery's gun is of the latter size, is of ·534 inch calibre, and weighs 400 lbs. The barrels are planed exteriorly to an hexagonal form, those of Major Fosbery's gun being rifled on the Metford system. They are fitted and soldered together, and to the wrought-iron tube which surrounds them and forms the barrel of the weapon. To this barrel, it will be seen, are screwed at the breech end two broad plates of wrought-iron. They are placed vertically, and are connected together at the end nearest the barrel by the ring into which the latter is screwed, and near the other end by a transverse bar. These plates form what is called the breech attachment. Placed between them are the breech-block and the lever, of which the long arm forms a handle—in Fig. 3 raised, depressed in Fig. 4. Attached to the short arm of the lever is a cylindrical mass of gun metal, confined to a box or recess of similar shape, in which it can be played freely to and fro. Short tubes are bored in the metal of this cylinder, corresponding in number and position with the barrels of the gun, and in each of these are placed a spiral spring and a small steel piston. On the face of the cylinder a perforated steel plate is screwed, through which the pistons project. They also pass through corresponding holes at the bottom of the recess in which the cylinder moves. In a vacant space which now occurs slides a vertical steel plate or shutter, and beyond we come to a second plate, screwed to the face of the main breech-block, containing a small point or striker, corresponding with each barrel, and therefore with each spring and piston in the movable cylinder. The vertical plate or shutter by which the strikers and pistons are separated, is moved by a transverse axle by means of two ratchet wheels, which take into tooth racks placed on the back of the plate. The axle is kept in position by a coiled spring, and is provided with a handle, which may be seen in both Figs. 3 and 4, on the right of the gun.

Turning back to the lever, we find that it is secured to the breech attachment by trunnions working in brass bearings attached to the side plates, and forming its fulcra. Its short arm is connected with the breech-block by a link formed of two pieces, furnished with left-handed screws, and united by a screwed collar, by turning which the link can be lengthened so as to compensate for any wear and tear in the working parts. By raising the handle of the lever the breech-block is drawn back by means of the link, and by the same means it is pushed forward and forced against the rear end of the barrels when the handle is depressed. As the lever, when the handle is depressed, rests against the bar uniting the plates of the breech attachment, it is obvious that the breech-block could be removed from its place only by a force sufficient to fracture the bar or the trunnions of the lever. No force is ever applied to it greater than that which arises from the explosion of a single cartridge.

The only remaining part of the gun is the cartridge-holder. It is a steel plate about half an inch thick, in which holes are bored, corresponding in position with the strikers and barrels of the gun, and made to fit accurately the heads of the cartridges. On either side of the gun is an ammunition-box, plates being carried ready filled in one, and boxes of cartridges occupying the other. Flanges forming perpendicular grooves are attached to the face of the breech-block, and in these the cartridge holder and extractor is made to slide vertically.

If the gun is to be loaded the lever is raised, when the breech-block is withdrawn to its utmost limit, the lock springs are freed from compression, and the points of the pistons rest lightly against the steel shutter behind which they are placed. A full cartridge-plate is dropped into its place, the strikers being pushed back by its bevelled edges as it descends. Next, the lever is depressed, when the breech-block advances, the cartridges are forced into their barrels, all the springs are compressed, and the pistons are urged against the steel shutter in front of them. When the gun is to be fired the handle to the right is turned. The shutter which is connected with the axle to which the handle is attached at once begins to descend, and as a vacant space is thus left for the pistons, they shoot, one after the other, across it, and come into contact with the strikers. The latter communicate the blow to the cartridges, which are immediately fired. To avoid friction between it and the pistons, the upper edge of the steel shutter is bevelled, and it is so cut into steps that two contiguous barrels are never fired consecutively. The whole thirty-seven are fired by $1\frac{1}{4}$ turns of the handle. At any point the firing may be stopped, and the fired cartridges be replaced, or the whole may be fired by a rapid motion of the handle. When the cartridges are exhausted, the lever is raised, the breech-block is drawn back, and the plate containing the empty cases is taken away. A fresh loaded plate is substituted, when the breech is again closed and the firing renewed.

Neither in the Gatling nor Montigny do the barrels radiate, as is generally supposed; they are arranged perfectly parallel. That such must be the case is indeed evident on slight consideration. For were it desirable to render the tubes in any way divergent it would be necessary, in the first place, to fix upon a specific range at which the arm should be used, as upon the locality of the target would depend the degree of radiation; thus, if the charge were regulated to spread in the most advantageous manner at a hundred yards, its effect would be very insignificant at ten times that distance, by reason of its very scattered nature at a point so remote from the gun. On the other hand a sufficient separation of the bullets is always brought about by the unavoidable discrepancies inherent even to a well-finished arm with parallel barrels; for even if the tubes were all mathematically true—a condition practically impossible to fulfil—very slight variations in the powder charge of the cartridges would always prevent the whole series of projectiles from pursuing a perfectly parallel course and lodging in the target within the same limits as those whence they started. As a matter of experience we may mention that the shooting is considered to be exceedingly correct, when at a fair range the whole thirty-seven bullets from the Montigny are lodged in a target measuring twelve feet square.

We need not here enter into the disputed question how far machine guns are capable of competing with the ordinary field guns. There can be no doubt that if the former be well constructed, they ought to be much more easily worked in the field than the latter. It is in their favour, too, that the effect of their projectiles does not, as is largely the case with field guns, depend upon the proper action of a fuze; and the extraordinary rapidity of their fire (the Gatling gun may be fired, when well manned, from 400 to 500 times per minute, and the Mitrailleur 370 times, or more) is a decided advantage. The absence of recoil by which they are distinguished is also noteworthy. The weak point of the Mitrailleur is its comparatively small range. There is no evidence that it can be fired with effect much over 800 or 900 yards, so that it is comparatively useless at distances which a field gun commands with ease. Moreover, its trajectory at short distances is said to be

rather high, and hitherto the cartridges have manifested a tendency to stick after having been fired. These facts alone would be decisive against trusting solely to the Mitrailleur. But it does not follow, because it is not good for all purposes, that it may not be useful for some. There are obviously many positions in which it might inflict great damage on an enemy. Doubtless much light will be thrown on its capabilities by the tests to which it is being submitted at Shoeburyness, and by the manner in which it bears itself among the fearful scenes in which it is at present playing a prominent part on the Continent.

NOTES

DR. C. H. SCHAIBLE has published a little pamphlet of 16 pages, entitled "Self-help on the Battle-field" (*Selbsthülfe auf dem Schlachtfelde:* Trübner), for gratuitous distribution among the German troops, and solicits its reprint in Germany. In spite of the great care now bestowed upon wounded soldiers, it is practically impossible, in great engagements, for all to receive immediate attention; and immense suffering is caused by their lying as much as two days on the battle-field without being removed. In these cases the wounded soldier is thrown entirely on his own resources; presence of mind and quiet judgment are indispensable at such a moment; but both are the result of a knowledge of the proper remedies. This knowledge the author undertakes to teach in a concise and sinple way, intelligible to every understanding. He first points out the articles required for immediate dressing, which might be carried by every soldier. He then explains the mode of arresting bleeding; the different steps in dressing the various kinds of wounds; the treatment of fractures; and concludes with some general rules. We earnestly hope it may afford some alleviation of the terrible sufferings caused by the present war.

NOTWITHSTANDING the announcement which was made to the contrary, the International Metric Commission met in Paris from the 8th to the 13th of August, for the purpose of some preliminary business, and then adjourned to a more favourable opportunity. Of the 25 foreign States which accepted the invitation of France, 20 were represented, viz., Austria, Chile, Colombia, Spain, the Roman States, the United States of N. America, Ecuador, Great Britain, Greece, Italy, Nicaragua, Peru, Portugal, Russia, San Salvador, Norway, Sweden, Switzerland, and Turkey. The bureau was constituted as follows:—President, M. Mathieu, of the Institute of France; Vice-presidents, M. Struve, of the Academy of Sciences of St. Petersburg; Prof. W. H. Miller, of the Royal Society of London; Prof. Henry, Secretary of the Smithsonian Institute of Washington; M. Herr, Prof. of Geodesy and Astronomy in the Polytechnic School of Vienna; and General Morin, of the Institute of France; Secretaries, M. Tresca, sub-director of the Conservatoire des Arts et Métiers; and M. Hirsch, director of the Observatory at Neufchâtel. The commission decided that the question to be proposed at a future time should be of two kinds, the first relating to the metre itself, the second to the kilogramme. A committee was appointed to carry out the needful arrangements in the interval before the next meeting, consisting of Prof. Airy assisted by Mr. Chisholm, Baron Wrède, and MM. Wild, Hirsch, Ibanez, Steinheil, Förster, Lang, and Hilgard.

WE regret to learn the death of Dr. Bolley, the celebrated professor of chemistry at the Polytechnic School, Zurich, which took place suddenly on the 3rd of August. He was a native of Heidelberg, where he was born in 1812, and had held positions as assistant and professor in the University of his native town, at the Cantonal School of Aargau, and the Federal Polytechnic School at Zurich. From 1859 to 1866 he was director of this school, and during that time the number of students increased greatly, being attracted from all the civilised countries of the world. He was a commissioner from the Federal Government to the London Exhibition of 1851 and 1862, and to that at Paris in 1867. The works by which he will be best known are his "Manual of Technico-Chemical Research," and his contributions to the most complete and valuable work on chemical technology. To his efforts is greatly due the foremost position which the Polytechnic School at Zurich enjoys among the technical schools of the Continent.

THE Dutch Scientific Society of Haarlem has proposed a series of questions to be answered by the 1st of January, 1872, among which the following are the most important:—1. To define, by anatomical and chemical researches, the mode of origin and the function of wax in living plants. 2. To explain, as much as possible by the aid of original researches, the history of the development of certain malformations and excrescences produced in the oak by different gall-making Hymenoptera. 3. To decide experimentally whether the roots of plants give rise to particular excretions, and in that case to establish the nature of the excreted matters. 4. To study the works of Huyghens, both with reference to the state of knowledge at his time, and with reference to its actual state. 5. The value of the constant of aberration, deduced by Delambre from the eclipse of the first satellite of Jupiter, and that which results from the more recent astronomical measurements, present a difference at present inexplicable. The observations respecting the eclipses of the first satellite of Jupiter are required to be collated, and a new determination of the constant of aberration to be deduced. 6. To make a new series of researches on the influence which the different colours of the spectrum exercise on the respiration of the green parts of plants. 7. To give a monograph of the flora of the sandhills of Holland. 8. To give a systematic description of the marine Phanerogamia.

WE have to announce that Dr. Debus, F.R.S., has been elected Lecturer on Chemistry in the medical school of Guy's Hospital; and that the practical classes of the institution will be under his direction.

DR. T. E. THORPE, of Owens College, Manchester, has been elected by the trustees of Anderson's University, Glasgow, professor of scientific chemistry in the room of the late Dr. Penny.

ON the 1st August severe shocks of earthquake were felt, about two in the morning, in several provinces of Greece, and were attended with disastrous results in the Parnasside and in Livadia. The town of Galaxidi and the villages of Khrusso and Arakhora suffered the most. The latter are nothing more than a mass of ruins; six of the people lost their lives, and all were more or less hurt. At Galaxidi all the houses were injured and some have crumbled to ruins; six children were crushed to death and about 150 adults were injured. Amphissa, the chief town of the province of the Parnasside, also suffered, but in a less degree. There seem to have been additional shocks the next day, but the dates are indistinct.

FROM official statements and from private letters received in London, we learn that Guatemala is suffering from the frequent occurrence and great destructiveness of earthquakes. The chief ravages are in the district of Cuajiniquilapa. The earthquakes have been daily from the 14th April to the last date, the 18th June, with the exception that after the 3rd May there was no shock for three days. The greatest shock was on the 12th June at 3 P.M. The motion was from S.E. to N.E., preceded by hollow rumbling. The church and chapel of the town were nearly destroyed. The principal parochial and municipal buildings, the prisons and custom-houses are in ruins. All the tiled private houses have suffered, especially those built of adobes or sunburnt bricks, only the straw huts escaped. The buildings in the coffee farms are destroyed, as also the fences and ditches. We suppose the fences are built of adobes or tapia. More damage has been inflicted in other parts of the country. The hills of Izquatan, Esclavos, and all about Cuajiniquilapa, exhibit extraordinary effects of the earthquakes. The earth has opened in deep rents, the most prominent of which run from S.E. to N.E. This, it will be seen, was the direction of the great earthquake of the 12th June. This shock lasted from ten to fifteen seconds. Some of the shocks have been tremulous, and others oscillating (*sic* in the Spanish). On the 18th June there were four shocks, between 6 A.M. and 4 P.M. The cause of the commotion is imagined to be in the volcanoes of Trocuamburro and Moyato, as it is known that great rocky precipices covered with trees have been thrown down, rivers dried, and roads blocked.

ON the night of the 12th July, in Salvador, Central America, the sky was dusky and overcast, but cleared off after some electric discharges. Next morning, at 4.50, there was an earthquake. This earthquake seems to have been felt in Guatemala on the same day, causing considerable damage in the departments of Santa Rosa and Jutiapa, particularly to farms, but attended with no loss of life.

IN a recent number of *Les Mondes* Dr. A. Boué calls attention to the fact that a great many scientific publications of the northern and easterly parts of Europe remain almost unknown, except in the countries where the languages (Swedish, Danish, Finnish, Lithuanian, Russian, Czech, Slavonic, Magyar, Polish, Neo-Greek, and Roumanian, and even Dutch) in which they are published are spoken. The author suggests that it would be an advantage if, for each of these publications, either a full translation or an abstract o the papers were simultaneously published in French, English, or German.

WE wish to call attention to a circular respecting the proposed Natural History Museum in connection with Clifton College. It is intended that the museum shall be essentially a British one, and contributions to illustrate the natural history and antiquities of our land are invited. We hope to revert to this admirable effort on an early occasion.

WE have received Sydney papers of May 28, containing a report of an interesting lecture delivered before the Royal Society of New South Wales, by the Rev. W. B. Clarke, on the progress of science during the past year in the Australian colonies.

THE Imperial Academy of Sciences of St. Petersburg has issued the first three parts of Vol. XIV. of their Bulletin; the contents are as follows :—Sur le dégagement d'ammoniaque par les champignons, El. Borscow; Quelques observations faites à 'Observatoire de Pekin—Lettre à M. Wild—M. Fritsche; Sur le genre Dinotherium, réuni à la famille des Elephants, et sur la craniologie comparée des genres de cette famille (Extrait), J. F. Brandt; Sur l'acide urinylique, nouveau produit de l'action de l'acide nitreux sur l'acide urique, N. Sokolof; Manuscrits orientaux de la Bibliothèque Impériale Publique, provenant de la succession de M. le Comte Simonitch, B. Dorn; La houille de Malewka; G. v. Helmersen; Appareil servant à fermer les stigmates chez la Blatte (*Periplaneta orientalis*), O. v. Grimm; Influence de la température sur la conductibilité de la chaleur de quelques métaux (Extrait), R. Lenz; Observations faites à l'Observatoire astronomique de l'Académie en 1868, A. Savitch; Recherches embryologiques sur le *Gyrodactylus*, E. Metchnikof; Recherches anatomiques sur les antennes des insectes, O. v. Grimm; Les canaux sémicirculaires du chat (avec une planche), O. v. Grimm; Une rectification de la table des forces élastiques de la vapeur aqueuse de M. Regnault—Lettre à M. Wild—H. Moritz; Etudes faites à l'aide d'un astro-photomètre de M. Zöllner, P. G. Rosén; Manuscrits orientaux achetés par le Musée asiatique de l'Académie aux héretiers de M. Graf, B. Dorn; Sur une nouvelle construction de mon Polaristrobomètre (Saccharimètre Diabetomètre) (avec une planche), H. Wild; Sur les aurores boréales du 15-16 Avril et du 13-14 Mai, 1869, H. Wild; Sur l'orage magnétique du 15-16 Avril, 1869, H. Wild; Quelques mots sur les Sturionides européens et asiatiques, J. F. Brandt; Nouvelles recherches embryologiques sur le *Bothriocephalus latus*, Dr. Knoch; Sur deux envois de monnaies, reçus au Musée asiatique, B. Dorn; Sur une méthode d'exprimer les perturbations d'une comète au moyen de séries rapidement convergentes, Dr. H. Gyldén; Propositions concernant la réorganisation du système des observations météorologiques en Russie—Rapport d'une commission, nommée par l'Académie; Réapparition de la comète de Winnecke et découverte de nouvelles nébuleuses, O. Struve; Notice sur l'absorption de l'hydrogène par le fer galvanique, M. H. v. Jacobi; Propriétés générales des polyèdres, qui, sous une étendue superficielle donnée, renferment le plus grand volume, L. Lindelöf; Sur les dérivés chlorés du toluol, F. Beilstein et A. Kuhlberg; La coupole de Mélik-el-Aschraf Abou-l-Nassr-Birsbay, M. Mehren; De quelques versions orientales du conte du trésor de Rhampsinite, A. Schiefner; Histoire de la génération des esturgeons—Communication préalable—A. Kowalewsky, Ph. Owsiannikow, et N. Wagner; Histoire de la génération du *Petromyzon fluviatilis*—Communication préalable—Ph. Owsiannikow; Nouvelles acquisitions de monnaies au Musée Asiatique. B. Dorn. From the same energetic and enterprising society we have the first part of Ruprecht's "Flora Caucasi," carrying down as far as Ampelideæ.

FROM *Cosmos* we obtain the information that M. Böttger has produced a new test-paper which is highly sensitive towards the alkalies and alkaline earths. The reagent is a magnificent colouring matter, obtained from the leaves of an exotic plant (*Coleus verschaffelti*), upon digestion for twenty-four hours with absolute alcohol, to which a few drops of sulphuric acid have been added. The paper is prepared for use by the usual process. The colour is a splendid red, which passes more or less rapidly into a fine shade of green, by the action of the alkalies or the alkaline earths. It is far more sensitive than turmeric; it is unaffected by carbonic acid, and will indicate the presence of the least traces of the carbonates of the alkaline earths in water. A moistened strip of the paper, when held at the opening of a gas jet, immediately assumes a green colour, if ammonia be present.

IT is proposed to erect a statue of Harvey, the discoverer of the circulation of the blood, in the Central Park, New York, and large subscriptions have been received for that purpose. It is to be of bronze, of colossal proportions, "representing Harvey at the moment he felt convinced he had made the great discovery that has immortalised his name." Verily the American sculptors have a pleasant task before them. How does a philosopher usually look under such circumstances?

AT a recent auction sale in New York, the finest known copy of "Elliott's Indian Bible" (Cambridge, 1663), printed in the Indian language, was sold for 1,050 dollars, about 210*l*. There is one copy of this celebrated Bible in the British Museum, one in the Island of Nantucket, and a third on Gardiner's Island, or Long Island Sound.

THE second part of Drs. A. and Th. Husemann's "Pflanzenstoffe," the first part of which we reviewed some time since, is still entirely occupied with the vegetable alkalies or bases, the most important treated of being Coniin, Chinin, Cinchonin, Coffein, Strychnin, Atropin, Nicotin, Hyoscyanin, and Veratrin. The third part, completing the work, is promised in September.

M. AUG. DUMERIL publishes, under the title of "Suites à Buffon," a second volume of his "Natural History of Fishes or General Ichthyology," comprising the *Ganoidei*, *Dipnoi*, and *Lophobranchii*, with an accompanying atlas of plates.

PAPERS ON IRON AND STEEL

I.—A Very Costly and Vexatious Fallacy

II.

THE greatest enemy to steel is phosphorus; one-tenth per cent. is sufficient to produce serious deterioration, and even to render the harder varieties of steel utterly worthless. As our common English pig-iron is made from clay iron-stones, many of the nodules of which contain, as nuclei or otherwise, the remains of fishes and other animal matter, they are exceptionally rich in phosphorus; and thus all the difficulties of steel-making are greatly increased in this country. There are few results in connection with the progress of British industry of which we have better reason to be proud than our pre-eminence as steel-makers, in spite of the greatest natural disadvantages; and this is the more remarkable from the fact that so great a triumph has been gained by illiterate men who have achieved it by following out with a remarkably sound though unaided sagacity the strict method of true Baconian inductive investigation. Whenever I meet a formulating book-stuffed pedant, I love to tell him of the great unconsidered fact, that while the learned men of the middle ages were muddling their intellects with worthless disputations, the artizans of that period were true inductive philosophers, and that the revival of science only commenced when the men of the universities adopted the method which had always been followed by the men of the workshop.

If the men of the universities have outstripped the men of the workshop in recent times, it is simply due to the fact that science has kept systematic record of its achievements, by means of which each worker has the full benefit of the labours of his precedessors and fellow-workers, and is able to start from the point where these left off; whereas the workshop observers and experimentalists have worked with little or no systematic co-operation. If such co-operation only among one set of investigators has done so much, what may we not expect when it shall not only be extended to the other, but when both sections shall co-operate with each other. This technical and scientific co-operation is the great want of the present age. The artizan needs scientific education, and the professors of science have much to learn from the great mass of facts included in the practical experience of the workshop.

But I must not at present be carried further away into this tempting digression, but return to my main subject by anticipating an objection which will probably be made. The manufacture of puddled steel may be supposed to refute all I have said respecting the impracticability of producing steel directly from English pig-iron. If steel fit for the manufacture of files, chisels, &c., could be made from ordinary English pig-iron by this process, all my statements certainly would be refuted, for puddled steel is simply made by checking the oxidation and arresting it at such a point that some of the carbon in the pig-iron shall remain unburnt.

The facts connected with the manufacture of puddled steel which bear upon the present subject, are as follows: First, puddled steel of merchantable quality cannot be made at all from *common* English pig-iron. Second, the manufacture of puddled steel has been much more successful on the Continent than in England. Third, only *mild* steel and that of an inferior quality is made by this process from English iron.

Referring to the first fact, I may mention that there is a great deal of mystery, and there have been a great many failures and much waste of labour, fuel, and iron in carrying out this process in England. In many forges where it has been tried it is now altogether abandoned, and where it is carried on with any degree of success there is usually much secresy maintained. Now the mystery is not in the puddling, as the necessary modifications in the supply of cinder and the working of the damper are well understood, and have been sufficiently explained in the specifications of abandoned patents and otherwise. The secret part of this process is in the selection of the pig-iron, or rather of the "blend" of pig-irons, for it is found that a mixture of certain brands of pig-iron is better than any single brand used alone.

My own experience in connection with this subject has been very interesting, and is, I think, worthy of record. When engaged as chemist in the works of Sir John Brown and Co. of Sheffield, I made careful analyses of all the numerous brands of pig-iron that are used for various purposes in these works. These I tabulated and kept continually before me, in order to compare their composition with the special uses to which they were applied, and the properties which they, or the material made from them, exhibited. The manager of the iron department was a remarkable example of one of those self-taught, unconscious Baconian philosophers I have above alluded to. He has, during many years, been observing, experimenting, and generalising his inductions consisting of a code of original rules for the manufacture of iron suitable for various purposes. Like the man who had talked prose all his life without knowing it, he has been following strictly the injunctions of the "Novum Organon" in discovering the best "blends" of pig-iron for manufacturing respectively armour-plates, rails, boiler-plates, angle irons, &c., &c.; and among his other mysteries were certain blends for making puddled steel. These he calls his "steel-irons." He selected these, like all the others, without having, or pretending to have, any knowledge of their chemical composition.

By quite a different path, *i.e.* upon purely theoretical chemical grounds, I had determined that certain brands among those I had analysed were the best fitted for making puddled steel, and was anxious to verify my theory. To have asked directly for a revelation of the iron manager's secrets would have been unreasonable, and therefore I simply gave him a statement of the analyses of these particular brands all arranged together, and called them "steel-irons," adding that for the best work I supposed that he mixed with them a proportion of a certain foreign brand. "Hush, don't talk so loud; I don't want these fellows to hear you. Who told you that I use these?" was the substance of Mr. Jevons's reply. My theoretical and his practical selection proved to be exactly the same in result. He had selected just those particular pigs which contained the smallest per-centage of phosphorus, and which relatively to their carbon contained the smallest proportion of silicon.

But this was not all. I had just concluded a number of experiments made for the express purpose of determining the function of manganese in the manufacture of iron and steel, and had come to the conclusion that its usefulness depends upon its readily oxidising, even before all the carbon is oxidised, and thereby affording a base with which the silica could unite and form a liquid and readily fusible silicate. Now this is just what is wanted in making puddled steel, and hence I suggested the addition of the highly manganiferous foreign ore. He had recently discovered that it did just what I expected, and supposed that his discovery was quite new. Such, however, was not the case, for this, like so many other trade mysteries, had been independently discovered by a number of other practical investigators.

The foreign manganiferous metal referred to is Spiegeleisen. Dr. Percy says "Spiegeleisen has been found admirably suited for the production of puddled steel of the best quality, and accordingly it is largely used for this purpose." Now spiegeleisen is remarkably free from those impurities which, as I have stated, cannot be removed from common English pig-iron without also taking out the carbon. I find that the average proportion of silicon to carbon in English pigs is about three-fourths; in spiegeleisen it is below one-fourth, and that the average proportion of phosphorus in the samples of spiegeleisen which I have analysed, is less than one-twentieth of the quantity contained in our Cleveland pigs. Three, four, and five hundredths per cent. is the quantity I ordinarily find in good German or Swedish spiegeleisen. The sulphur seldom exceeds one-tenth per cent., and the large quantity of manganese materially assists in the removal of the silicon. It is, in fact, very similar to the Styrian cast-iron, which, as I have already said, does not present the English difficulty of making steel by the direct process. Both are charcoal-irons, made from remarkably rich and pure ores. The manufacture of cast-iron from such ores, and steel from such cast-iron is mere child's-play compared with our native manufacture.

In reference to the second fact that the manufacture of puddled steel has been carried out more successfully on the Continent than in England, I need only say that this confirms my statements, as the puddlers there are less skilful than ours, and their raw material is a vastly superior charcoal-iron, such as I have already described.

The third fact, viz.: that only *mild* steel of inferior quality is made by this process, is further confirmation of what I have said respecting the necessity of removing the carbon from common pig-iron in order to purify it sufficiently to produce good steel; for even with all this skilful selection of the purest pigs, and the mixing of spiegeleisen with them, it is found in this country impracticable to make puddled steel containing more than one-half per cent. of carbon. Such steel is only fit for rails, tyres, for rubbish cutlery, and other purposes where a very soft steel, or rather steely iron, is used. If the puddling were stopped when the carbon was only reduced to about 1·75, or say 1·5 per cent. (the quantity contained in the best hard cast-steel), the puddled steel would be utterly rotten, it would crush under the hammer whether hot or cold; the reason of this being that even with the best English pigs, the selected "steel-irons," there would, with this amount of carbon, still retain a ruinous proportion of silicon, phosphorus, &c. It is necessary with all available advantages to bring down the carbon to within one half per cent. in order to produce a workable material. Even then it is worth only about one third of the price of good cast-steel.

I might illustrate this subject still further by entering into the details of the chemistry of the Bessemer process and of Bessemer steel, by the history of the nitrate of soda process, and of other attempts to manufacture steel directly from cast-iron; but I think the above is sufficient to expose the fundamental fallacy upon which all such attempts have been founded. I hope to have succeeded more particularly in demonstrating the very great error of those who, in their attempts to make such steel, have, like the friend of my correspondent whose letter opens this paper, deliberately chosen cinder-pig or other inferior iron upon which to make their demonstrative experiments. This was the case with the Heaton Company. They worked for a long time at Langley Mill with one of the worst classes of pig-iron they could have selected for their purpose. I pointed this out to them in a letter printed in the *Chemical News* of February 19, 1869. This effort, the most promising of any of the kind, on account of the action of the residual alkaline soda, was, through this serious mistake, never fairly tested. I witnessed some of their experiments, and analysed and otherwise tested the results. There can be little doubt that with properly selected pigs a material similar to puddled or Bessemer steel, may be made by this process, and by several others that have been tried and have failed; but with the common classes of English pig-irons, all such attempts to make steel directly by the partial oxidation of the carbon must of necessity fail, unless some entirely new, some hitherto utterly unknown method of removing the silicon, phosphorus, and sulphur of the pig-iron is also used. In such a case the novelty, the invention, the triumph, would consist not in the decarburisation of the cast-iron, but in the separation of the other ingredients.

I therefore recommend all inventors who seek to simplify or otherwise improve the manufacture of steel, to direct their attention first to the removal of phosphorus, next to the removal of silicon, thirdly to the removal of sulphur, and last and least of all to mere decarburisation, for that is a problem of the utmost simplicity, and already sufficiently understood.

My next paper will be "On the Chemistry of the Bessemer Process," and will include some original observations, the results of which I believe to be of considerable value to the numerous manufacturers who are now erecting or working Bessemer plant. W. MATTIEU WILLIAMS

SCIENTIFIC SERIALS

POGGENDORFF'S *Annalen der Physik und Chemie*, vol. cxl., part 2.—This number of Poggendorff's *Annalen* contains (1) the conclusion of Ketteler's paper on the theory of Chromatic Dispersion. (2.) The conclusion of Sondhaus's paper on the "tones of heated tubes, and on the vibrations of air in organ-pipes of various shapes." In this part the author compares his formula with Wertheim's experimental results, and shows that in most cases the agreement between them is very close. (3.) The conclusion of Freese's paper on chromates. (4.) "On the work done by gases in motion," by L. Boltzmann. In the first volume of the *Annalen* for 1869 (vol. cxxxvi.), a method of determining the specific heat of air under constant volume is described by F. Kohlrausch, the method consisting essentially in observing the cooling effect indicated by a delicate metallic thermometer enclosed in the receiver of an air-pump when the piston is raised. A few months afterwards (Pogg. *Annalen*, vol. cxxxviii.) Kohlrausch's experiments were criticised by A. Kurz, who objected to them that when the air in the receiver of a pump is expanded by drawing up the piston, it does no work; and that, therefore, theoretically, its temperature ought not to fall. This is of course an obvious blunder; and Boltzmann shows, by a strict mathematical discussion of the experiment, that although the pressure of the air against the piston, and therefore the work done by it, is not quite so great when the piston is raised quickly, as it would be if the movement were indefinitely slow, yet the difference is only a quantity of the same order as the ratio of the velocity of the piston to the velocity of sound, and therefore cannot have perceptibly affected Kohlrausch's results. (5.) "Calculation of the vibrations of a string, taking account of its rigidity," by R. Hoppe. (6.) "On asterism and corrosion-figures in crystals," by H. Baumhauer. (7.) "Comparison of the electrophorus with the electrical machine and the electrophorus-machine," by P. Riess. This paper contains some interesting historical notices of early electrical machines, both frictional and such as acted by induction, but we cannot see that it is of any importance as a contribution to the theory of electrical machines. (8.) "On the velocity of molecular motion and that of sound in gases," by E. Mulder. The author seeks to establish a relation between the velocity of sound in a gas and the mean velocity of translation of its molecules, as deduced by Clausius from the dynamical theory of heat. (9.) "On the production of stationary vibrations and sound-figures in liquidsand gases by solid sounding plates," by A. Kundt. (10.) "On elastic vibrations," by J. J. Müller. By a modification of Kundt's method of measuring the wave-lengths of vibrating columns of air, the author has succeeded in proving that the velocity of propagation of vibrations of great amplitude is perceptibly greater than that of vibrations of small amplitude, both in the case of columns of air and of elastic rods. (11.) "On Leclanché's Manganese battery," by J. Müller. The author finds that polarisation occurs to a considerable extent in galvanic cells of Leclanché's construction when they are employed in a circuit of small resistance, so that under these circumstances he found the electro-motive force of a Leclanché's cell to be only 0·896 of that of a Daniell's cell, whereas, according to Leclanché, it is equal to 1·38 times the electro-motive force of a Daniell's cell. (12.) "On the occurrence of augite-material in meteorites," by C. Rammelsberg. (13.) "On the Lodran meteorite," by G. Tschermak. (14.) "On acoustic attraction and repulsion," by K. H. Schellbach. Additional facts, but as yet no explanation of these curious phenomena. According to the author, the attraction of light bodies by a vibrating tuning-fork was observed and described by Guyot in 1834. (15.) "On the maximum-density and freezing point of mixtures of alcohol and water," by F. Rossetti. This is a short extract from the author's researches on the expansion of water and certain solutions, published in greater detail in the *Annales de Chimie et de Physique* for 1867 and 1869 (vols. x. and xv.). (16.) "A Method of Examining the Structure of Flames," by L. Dufour. The flame is cut across horizontally by a flat lamellar jet of water or of air, and can then be examined at leisure by looking down into it from above. (17.) "Remarks on the colour of iodine," by Carl Schultz-Sellack. The author calls attention to the different colour of iodine in the solid state, or when dissolved in water, alcohol, &c., from that which it shows in the state of vapour, or when dissolved in sulphide of carbon, stannic chloride &c., iodine transmitting in the former case chiefly the extreme red rays of the visible spectrum, and, in the latter case, chiefly the blue and violet rays. He argues that this difference of absorptive character between solid or liquid and gaseous iodine is analogous to the difference which exists, according to Magnus, between the absorptive action of liquid and gaseous water on invisible heat-rays. (18.) Prof. Nordenskiöld announces the discovery of *platinum* as well as gold in the sand of the river Ivalo in North Lapland. (19.) The genuine character of the diamond lately found in Bohemia has been proved by Prof Schafarik by burning a portion of it in oxygen.

Journal of the Chemical Society, July and August, 1870.—The whole of the July number and 22 pages of the August number of this periodical are occupied by the continuation of the very elaborate and exhaustive paper by Dr. Divers on the combinations of carbonic anhydride with water and ammonia. The half acid ammonium carbonate which was previously considered to be represented by the formula $(CO_2)_3\,(OH_2)_5\,(NH_3)_4$ is found by Dr. Divers to contain $(CO_2)_3\,(OH_2)_4\,(NH_3)_4$; when exposed to the air it loses water and ammonia, being transformed into the acid carbonate $CO_2\,OH_2\,NH_3$, of which 8 modes of preparation are described. Another compound obtained in an impure condition by Rose, is considered by the author to have the composition $(CO_2)_5\,(OH_2)_4\,(NH_3)_4$. He also thinks it probable that the orthocarbonate $CO_2\,(OH_2)_2\,(NH_3)_4$ or $CO_4\,(NH_4)_4$ exists. The modes of preparation and properties of ammonium carbamate $CO_2\,(NH_3)_2$ are fully described. The formula attributed to the commercial carbonate of ammonia is $(CO_2)_2\,OH_2\,(NH_3)_3$. The whole of this memoir bears evidence of most careful research and perseverance; the history of the compounds mentioned is traced out; the modes of preparation and properties are carefully described, and very numerous analyses have been made in order to ascertain their composition. Mr. Charles Griffin describes a new gas furnace for chemical operations at a white heat, which does not require a blowing machine. The gas is supplied to this furnace through a bundle of 16 Bunsen's burners, the upper ends of which are surrounded by a metal jacket fitting into a perforated clay plate supported on a tripod. When large crucibles are to be employed, a plumbago cylinder open at both ends and pierced with holes is placed on the clay plate, the conical crucible being supported by the upper end of the cylinder. The crucible and plumbago cylinder are surrounded by a fireclay cylinder resting on three bronze pennies placed on the lower plate. The cylinder is closed at the top by a clay plate, through which a flue is so made that the current of spent gases is bent twice at right angles before escaping into the sheet-iron chimney; the object of this flue is to check the stream of gas which would otherwise be so great as to cool the furnace very considerably. When small crucibles have to be heated, they must be supported on a grate consisting of a clay plate with a cusped aperture. By means of this furnace, ingots of cast iron 4lbs. in weight have been fused in 2½ hours, starting with a cold furnace; when the furnace is hot, 5lbs. could be fused in the same time; the quantity of gas used is 33 cubic feet per hour. The cylindrical body of the furnace may be replaced by one of an oval shape, and containing a muffle in which many operations may be performed, the temperature inside the muffle being sufficiently elevated to fuse silver, gold, and copper. The remainder of the August number is devoted to the proceedings of the society during the session of 1869-70, and a report of the anniversary meeting held on March 30, the latter including the President's address and obituaries of Mr. Brayley, F.R.S., Dr. Graham, F.R.S., Mr. A. B. Northcote, M.A., Dr. Penny, F.R.S.E., and of the late foreign members, Drs. Erdmann and Redtenbacher. These are followed by the list of papers read during the year; the balance-sheet, which shows the society to be in a prosperous condition; and the donations to the library.

SOCIETIES AND ACADEMIES

New Zealand

Wellington Philosophical Society, June 25.—W. B. D. Mantell, F.G.S., president, in his address, directed attention to the large additions made during the past year to the collection of fossil Reptilian remains in the Museum by the officers of the Geological Survey. Several genera are represented, but owing to the nature of the matrix, which exceeds in hardness the most refractory of the "Tilgate" beds, their development will be a work of great difficulty.—Walter Buller, F.L.S., exhibited and described a specimen of the now almost extinct New Zealand Rat or Kiori—in former days a highly valued article of food among the natives, and pointed out its striking resemblance to the ancient black rat of Britain.—T. H. Potts exhibited chicks a few days old of *Anarhynchus frontalis*, showing the characteristic crooked bill, and also the eggs and manner of nidification, along with those of *Charadrius bicinctus*; completely establishing the marked difference between the two birds.—W. T. L. Travers, F.L.S., gave an account of the habits of the Crested Grebe in New Zealand. He has reason to think that they pair for life, and stated that they make additions to the height of their nests, as inundation takes place, but that the eggs will retain their vitality though immersed in water for a considerable time, and inferred that this might have some connection with the coloured mucous layer with which the shell becomes coated during incubation.—Dr. Hector said he had found the nest containing eggs in a tidal lagoon, where it must have risen and fallen with the tide. The eggs were not discoloured. He also exhibited a dusky variety of the bird along with its chick, which is only found on unfrequented inland lakes.—Dr. F. J. Knox exhibited sections of the teeth of a *two-toothed Berardius*, and showed that, from the high state of development, they are not rudimentary as has been surmised, and yet they never appear to protrude through the gum.—John Buchanan exhibited a hybrid between the Australian *Acæna ovina*, which has been lately introduced with imported cattle, and the New Zealand *Acæna sanguisorbæ*.—Dr. Hector, F.R.S., called attention to the practical importance of knowing what fish belonging to the Salmonidæ are found in the New Zealand streams, as the English trout is being rapidly introduced throughout the country. Only one species, *Retropinna richardsonii* (the New Zealand smelt), is mentioned in the latest works as being found in New Zealand; but he exhibited in addition two very distinct forms, one having the same general character as that fish, but with dentition and form of head of an *Osmerus*. The third form is easily distinguished by its small head, forward position of the dorsal fin, small soft mouth devoid of teeth except a feeble row along the upper jaw. It is the common Opokororo of the natives, and grows to a very considerable size in some of the rivers and lakes. He also exhibited drawings of a specimen of *Scopelus* which he had obtained in Milford Sound, as a fourth fish related to the Salmonidæ.

Paris

Academy of Sciences, Aug. 22.—A note was read by General Morin on the first session of the international metric commission, held from the 8th to the 13th of August.—A letter was presented by Professor Newcomb of Washington to M. Delaunay on irregularities in the moon's motion due to the influence of the planets.—A note was read from M. Laranja e Oliveira on a remarkable atmospheric electric shock experienced at Porto-Alegre, Brazil, on June 9th.—M. Chapelas reported his observations on the August shooting-stars. He remarked that the year has been distinguished by a smaller number of shooting-stars than has been known for a long period. The periodic display commenced in the last days of July, but the determination of its maximum presented great difficulty, both from the almost constantly clouded condition of the sky, and from the moon being at her full. During the night of the 10th, in which there was an hour and a half favourable for observation, with an average clear sky amounting to 0·6, forty-six shooting stars were observed, among which were two meteors of the third magnitude. Their mean direction was (as is generally the case, and especially at that hour, $10^h\,15^m$ to $11^h\,45^m$) from

N.E. to N.N.E. The point of radiation was very difficult to determine owing to the small number of meteors. The constellations in which most appeared were Perseus, Cassiopeia, Camelopardus, and Aquila. Correcting the number observed for the influence of the moon, we get a mean at midnight of fifty-six shooting-stars per hour in a clear sky, or three more than last year; so that the phenomenon may be considered stationary. At 1 A.M. the sky was completely obscured, and the exact hour of maximum cannot be indicated; but during the time observed the phenomenon proceeded at the rate of ·6 stars per minute.—M. d'Avezac presented, in the name of the author, Don Salvador Clavijo, a general in the Spanish army, resident at the Canaries, a work entitled *Reflexiones sobre el sistema planetario*, on the rotation on their axis of the bodies comprising the solar system, planets and comets.

BERLIN

German Chemical Society, July 25.—M. Küchenmeister has obtained two different naphthoic acids corresponding to the two naphthols, by treating the two naphthylsulphates with cyanide of potassium and the cyanides with potash. One of the acids melts at 217°, the other at 230°.—C. Gräbe has continued his researches on the higher hydrocarbons of coal tar. After treating them with sulphide of carbon, which dissolves chrysen, there remains an impure substance which, when acted on by picric acid, forms a combination crystallising from alcohol in red needles. Decomposed with ammonia, they leave white scales of *pyrrhen*. To this hydrocarbon Laurent allotted the formula $C_{15} H_{12}$. Gräbe's determinations lead to the formula $C_{16}\ H_{10}$, borne out by the picrate $C_{16}\ H_{10}.\ C_6\ H_2\ (NO_2)_3\ OH$. Oxidation with bichromate of potassium and acetic acid yields the chinone $C_{16}\ H_8\ O_2$, from which zinc separates the hydrocarbon $C_{16}\ H_8$. The nitro-compound $C_{16} H_9\ (NO_2)$, and the two bromides in which two and three atoms of bromine take the place of hydrogen, have also been investigated. The author considers his hydrocarbon as phenylen naphthalin, $C_{16}\ H_{10} = C_{10}\ H_8 + C_6\ H_6 - H_4$.——Messrs. Gräbe and Caro have investigated the base contained in impure anthracene, to which, on account of its action on the mucous membrane, they have given the name of acridine. To obtain its sulphate, the impure hydrocarbon is treated with sulphuric acid, and some bichromate of potassium added to the filtrate. It shows a blue fluorescence, and its composition corresponds to the formula $C_{12}\ H_9\ N$, or a multiple of it.—M. Hofmeister publishes researches on phenylic ether and diphenylenic oxide. The former body is obtained by treating sulphate of diazobenzol with phenol, adding potash and distilling the insoluble residue, or by heating together sulphate of aniline, phenol, and nitric acid. It melts at 28°, distils at 240°, is not attacked by zinc, yields with PCl_5 a chloride (not yet analysed), and with sulphuric acid a conjugated acid $(C_6\ H\ S_4O_4\ H)_2\ O$.—Lesimple has described a body obtained by distilling phosphate of phenyl, under the name of phenylic ether; ascribing to it the melting point 80° and the boiling point 273°. Hofmeister proves the real formula of this body to be not $(C_6\ H_5)_2\ O$ but $(C_6\ H_4)_2\ O$.—M. Beer has transformed benzophenon $(C_6\ H_5)_2\ CO$ into the chloride $(C_6\ H_5)_2\ C\ Cl_2$, and this by finely divided silver into the hydrocarbon $(C_6\ H_5)_2\ C = C\ (C_6\ H_5)_2$ tetra-phenylated ethylene. Products of substitution have been formed with NO_4, HSO_3 and Br. The bromide has the composition $C_{26}\ H_{17}\ Br_5$.—M. Schöne has obtained a combination of peroxide of barium and peroxide of hydrogen. This compound $Ba \left\{ \begin{matrix} -O-OH \\ -O-OH \end{matrix} \right.$ is formed by mixing peroxide of barium with a solution of ½ per cent. of peroxide of hydrogen in water. At 10° it forms colourless monoclinohedric crystals resembling heavy-spar. At ordinary temperatures it becomes yellow, and yields water, oxygen, and peroxide of barium. This explains why alkaline solutions of peroxide of hydrogen are unstable.—V. Meyer communicated his views on the constitution of gallic acid.—Professor Hofmann then rose to report in his name and that of several of his pupils on the following researches partly unfinished, the war having called assistants and pupils from the laboratory into the field.—M. Bischoff, passing chlorine through an alcoholic solution of prussic acid, has obtained two crystalline substances $C_8\ H_{14}\ Cl_2\ N_2\ O_4$, already obtained by Stenhouse, and a new body $C_8\ H_{15}\ Cl\ N_2\ O_4$. Treated with acids or alkalis, they yield carbonic acid, ammonia, hydrochloric acid, and also ethylenic ammonia and a brown substance probably containing very complicated bases.—M. Melens, by treating acrolein with cyanic acid, has transformed it into a kind of trigenic acid.—M. Judson has transformed crotonchloral by oxidation into trichlorocrotonic acid and the salts and ethers of the same. The silver-salt boiled with water yields carbonic and hydrochloric acids, and the chloride $C_3H_2Cl_2$, identical or isomeric with chlorinated allylene. This body can also be obtained by treating crotonic chloral with alkalis. By treating the chloral with perchloride of phosphorus, O is replaced by Cl_2, hydrochloric acid being eliminated at the same time: $C_4\ H_5\ Cl_3\ Cl_2 - H\ Cl = C_4\ H_2\ Cl_4$.—M. Reimer has studied the butylamines. The bromide of tetrabutylamine can not be obtained. It yields at once butylene and hydrobromide of tributylamine.—M. Reiss has prepared butyl-benzol and butyl anisol.—Professor A. W. Hofmann reported on his protracted researches on the green colouring substance obtained from rosaniline by the action of aldehyde and hyposulphite of sodium. Not forming any combinations and not crystallising, this substance could only be purified by frequent solution and reprecipitation. Numerous analyses lead to the formula $C_{22}\ H_{27}\ N_3\ S_2\ O$ corresponding to one molecule of rosaniline, one of aldehyde, and two of hydrosulphuric acid combined. Rosaniline treated with hyposulphite without the intervention of aldehyde yields a similar product from which acids reproduce rosaniline.—The same chemist, in treating bromide of ethylene with ammonia, has observed the formation of an insoluble white amorphous powder, exhibiting the strange property of absorbing large masses of water and swelling up to a voluminous gelatine. The substance (probably a mixture) corresponds to the formula $\left. \begin{matrix} (C_2\ H_4)_4 \\ H \end{matrix} \right\} N_3$ combined with H Br, $H_2\ Br_2$ or $H_3\ Br_3$. But triamines being soluble, it is very likely that the formula should be multiplied.—The same chemist, when preparing cyaniline 25 years ago, observed that the mother-liquor treated with hydrochloric acid, yields dark red crystals. He has at last succeeded in purifying them, and establishing their formula $= C_{21}\ H_{17}\ N_5.\ HCl$—a triphenylated guanidine $N_3.\ C^{iv}.\ (C_6\ H_5)_3\ H_2$, in which two molecules of cyanogen have combined with two molecules of phenyl. If, however, triphenylated guanidine is treated with cyanogen, a body is formed of exactly the same composition, but of very different properties. The latter is colourless, and is transformed by acids into aniline, carbonic oxide, hydrogen, diphenyl oxamide, and diphenylated parabanic acid; whereas the former, when treated with acids, yields aniline, oxalic acid, and ammonia.—The same chemist has studied the action of triethyl phosphine on cyanate of phenyl, and found the resulting body to be not a cyanurate, but a new substance combining with alcohols, ammonia, &c.—A. Baeyer reported on some further derivatives of mellitic acid.—Mesohydro mellitic acid appears to be the first aldehyde of hydromellitic acid, and derives from it by the action of sulphuric acid and bromine. It is tetrabasic and beautifully crystallised. Only one acid is now wanting to complete the series, beginning with benzoic and ending with mellitic acid. The clue to obtain this acid appears to have been found. The same chemist has obtained a derivative from tetrahydrophthalic acid, which appears to be quinic acid.—Professor Rammelsberg then concluded the meeting by expressing his fervent hopes that a speedy victory of the German arms would allow all members of the society to resume their peaceful pursuits before the reassembling of the society in October.

NEW YORK

Lyceum of Natural History, April 4.—The President in the chair.—Dr. J. S. Newberry "On the Earliest Traces of Man found in North America." Dr. Newberry stated that the human relics for which the highest antiquity had been claimed were the Natchez bone and Table Mountain (California) skull. If it could be shown beyond question, that these bones really occurred in the positions to which they have been referred, we should have evidence that man existed on this continent as a contemporary with the mammoth, mastodon, and other extinct mammals, and at a period so remote that all the topographical features of the surface have since changed—in the case of Table Mountain the bottom of a valley having become a mountain summit. As regards the Natchez bone, geological changes have been effected since the date assigned it, which, in Sir Charles Lyell's judgment, must have required a hundred thousand years. In neither of these instances were the human remains actually found by credible persons in strata of high antiquity, and no dependence whatever can be placed upon inferences made from this material in the solution of the question of the antiquity of man. We may to-morrow obtain indubitable evidence of the occurrence of the remains of man in the Table Mountain tertiaries and the Vicksburg bluff; but until such evidence be discovered we must discuss the question leaving these hypothetical cases entirely out of view. No solid and enduring scientific fabric can be reared on doubtful premises. The caves of our country have as yet scarcely been entered upon as ground for archæological research. But one cavern has been examined with any care, that of Carlisle, Pa., by Professor Baird—and this may be said to have been but partially explored. Human remains were found in it, but not of special interest. The fauna represented by the great number of bones collected there, is essentially the same with that which occupied the country on the advent of the whites. This remarkable fact, however, is reported by Professor Baird, that all the species represented in the collections made in the Carlisle cave, have degenerated in size, and this modern degeneracy ranges from ten to twenty-five per cent. The shell mounds on the Atlantic coast, north and south, have been partially investigated by Prof. Wyman, Prof. Baird, and others. In these mounds human remains are constantly met with, but none which can serve as proof of great antiquity. Perhaps the best evidence that these shell mounds are of ancient date, is furnished by the facts reported by Prof. Baird, that those of Maine contain the bones of the great Auk (*Alca impennis*) and those of the walrus. Of these the first is supposed to be entirely extinct, and both in modern times have been confined to higher latitudes. The mounds of the western states, the copper mines of Lake Superior, the old oil wells of Pennsylvania, and the lead mines of Kentucky, really afford us the only traces of human occupation yet found within our territory which have a respectable antiquity, and one which can be measured even negatively in years. All these traces of the ancient semi-civilised people that once inhabited the Mississippi valley, are found overgrown by what we term the "primeval forest," in which are trees five hundred years old; and these trees, in some instances, are growing on the prostrate trunks of individuals of equal size, belonging to a preceding generation. This, then, is the record. We can positively assert that the works of the mound builders were abandoned and overgrown by forests a thousand years ago; how much before that time we have no means of knowing. We may fairly infer that some hundreds of years were consumed in the multiplication of this ancient people, in their spread over and subjugation of the country they occupied, in the substitution of cultivated farms for the pre-existent forest, in the construction of towns so numerous as to thickly dot all the surface, in the thorough exploration and extensive working of the mineral districts and oil fields, in the acquisition of the degree of civilisation they attained, in their gradual reduction in numbers to their total extinction. In New Mexico, Mexico, Central America, and Peru, we have countless monuments of a civilisation generically the same throughout this great area, and a civilisation which was indigenous to America. For the rise, culmination and decline of this civilisation—for it was in its decadence when Columbus first discovered America—we must allow two thousand or three thousand years. Perhaps they occupied much more time than this; but all these changes could hardly have been effected in less than two thousand years. Whether there was any relationship between the ancient Mexicans and the mound-builders is a question yet to be decided. They had this in common, that both were sedentary and agricultural; were miners and builders. But the Mexicans and the Incarial race were famous masons, and built huge structures of dressed stone which scarcely suffer in comparison with our finest architectural monuments. The mound-builders, on the contrary, build in earth and wood, and the structures they raised have little in common, so far as plan is concerned, with those of the southern nations. No geographical connection has been traced between these ancient civilisations. The one seems to have been strictly confined to the Valley of the Mississippi, the other to the high table lands lying between the Rocky Mountains and the Sierra Nevada. In answer to inquiries, Prof. Newberry stated that the inscriptions which covered the monuments of Central America and Peru, like the arrowhead characters of Assyria, and the hieroglyphics of Egypt, were destined to be read. Indeed, it might be said that many of these inscriptions could now be read. But little was to be expected, however, in the way of historical facts, from a perfect translation of all these records. They were apparently, for the most part, local and personal in character, and like the Egyptian and Assyrian records, consisted mostly of religious invocations, laudation of persons, or celebrations of local and temporary political triumphs, which to us have no special significance or value. The mining operations of our ancient Americans were so extensive, that most of the important deposits of copper on Lake Superior had been not only discovered, but worked by them. The working of the oil wells by the mound-builders had not perhaps been noticed by others, but Prof. Newberry asserted it from observations he had himself made. On the bottom lands of Oil Creek, below Titusville, he had, in 1860, noticed that the ground in the primeval forest was pitted in a peculiar way, the pits two or three feet deep, eight or ten feet in diameter, and almost contiguous. These were proved (by excavations made preparatory to boring oil wells) to be the remains of ancient wells or pits sunk in the alluvial clay. One of these, opened to the depth of twenty-seven feet, was cribbed up with timber, and contained a ladder like those found in the ancient mines of Lake Superior, formed from the trunk of a tree on which branches were left projecting six or eight inches. Prof. Newberry had subsequently seen similar pits to these, around the oil springs of Mecca and Grafton, Ohio, and at Enniskillen, Canada West. In the latter locality, a modern oil well cut into the circumference of an ancient one, and this was found to be filled with sticks and rubbish. A pair of deer's horns were taken out thirty-six feet below the surface. The lead vein in Kentucky, to which reference had been made, had been worked by an open cut several hundred yards in length. This was now a ditch some feet in depth, with a ridge of material thrown out on either side, the whole was covered by forest, and trees three feet in diameter were growing upon the ridges of rejected rubbish.

April 11.—The president in the chair. Mr. O. Loew "On Hydrogenium-Amalgam." He showed that when zinc-amalgam is agitated with a weak solution of bi-chloride of platinum, a spongy mass forms upon the surface of the zinc-amalgam, having buttery consistence, and strongly resembling in physical characters, the well-known ammonium-amalgam. This body he considers to be an amalgam of hydrogenium and mercury. To prepare it on a large scale, he shakes thoroughly zinc amalgam, containing three per cent. of zinc, with an equal volume of a solution of bi-chloride of platinum, containing ten per cent. of the salt. The mass becomes warm, and must be cooled from time to time, by plunging the flask, in which the reaction is carried on, into cold water, and also takes on a black colour from the finely divided platinum which is reduced. The mixture is then thrown into moderately dilute hydrochloric acid, by which the excess of zinc and oxychloride formed is dissolved. Unless thus treated, the amalgam is rapidly decomposed with evolution of hydrogen. The platinum is, for the most part, removed with the excess of mercury. The body thus prepared, has the consistency and appearance of ammonium-amalgam as obtained by acting upon an ammonium salt with sodium amalgam. At ordinary temperatures, several days are required for its complete decomposition. It possesses the marked reducing power peculiar to hydrogenium, reducing ferricyanides to ferrocyanides, per salts of iron to proto salts, decolourising permanganate of potassium, &c. This hydrogenium-amalgam also absorbs ammonia, and the resulting body resembles ammonium-amalgam as otherwise obtained. Since Graham compared hydrogenium with the active modification of oxygen, Mr. Loew proposed to consider the following series as parallel:—

Antozone.	Common Oxygen.	Ozone.
Nascent Hydrogen.	Common Hydrogen.	Hydrogenium.

And he further suggests the representing of these three states of hydrogen, by formulæ in the following manner.

[H]	[H H]	[H H] H
Nascent Hydrogen.	Common Hydrogen.	Hydrogenium.

He performed the experiment as described, in a most satisfactory manner, producing a large mass of the supposed hydrogenium-amalgam. The reading of this paper elicited considerable discussion. Dr. I. Walz, spoke in high terms of Mr. Loew's ingenious experiment, but opposed his theoretical views; especially the comparison of nascent hydrogen and antozone, the existence of which he denied. He exhibited the action of bi-chromate of potassium and zinc-amalgam when shaken together, whereby the former is reduced, and apparently a compound of hydrogenium and mercury obtained, which differed in characters somewhat from that exhibited by Mr. Loew. Prof. C. A. Joy referred to the experiments of Schönbein, which conclusively prove, he considered, the existence of Antozone. Schönbein agitated zinc-amalgam with water, and examined the solution obtained. This did not act upon iodide of potassium and starch, until a trace of a proto-salt of iron was added, when immediately the blue colour of iodide of starch appeared. The use of bi-chloride of platinum for assisting the evolution of hydrogen, originated with De la Rive. He thought that Mr. Loew had gone a step farther than either Schönbein or Graham in this most important discovery.

April 18.—The president in the chair. The president made some remarks on the metalliferous deposits of the West, stating it as his opinion, that the production of gold had passed its climax; giving his reasons for so believing. Gold is found disseminated over vast regions in the West; the accumulations in the placers having been worked for ages. He then entered into a description of the manner in which the accumulation of metal had taken place. There is still plenty of gold everywhere, but it is very difficult to separate it from the associated rock in which it is embedded. Those deposits where it could be readily procured, are beginning to be exhausted. The mountain system of the West, cnsidered with respect to the mineral wealth of that portion of the country, he considered divisible into belts, the westernmost or coast range producing mercury, the next eastward or Sierra Nevada Range, is very rich in gold. In the Rocky Mountains, the gold is associated with copper and iron pyrites. In Montana, the gold-bearing veins are extremely rich in that metal, but very difficult to work. Between the Rocky Mountains and the Sierra Nevada there occurs an argentiferous belt stretching through Idaho, Nevada and Montana; it is in this region that the celebrated Comstock Lode is situated, which, up to the present time, has yielded 75,000,000 dollars. The agricultural portions of California, and the region eastward of the mountains, is of little value except for its mineral wealth, and, if it ever becomes important, it wi l be by the development of these deposits.

April 25.—The president in the chair. Prof. A. M. Edwards read a paper "On the presence of living insects in the human body," showing that several such cases were on record. In one case a fly had been reared from a larva ejected from the human intestines. As such larva are found mostly in decayed fruit, the plan to be followed for preventing the unpleasant results sometimes, although not always, arising from the introduction of such insects by the mouth, is to avoid eating such fruit or vegetables in a raw condition as are at all decayed.

May 2.—The president in the chair. Prof. A. M. Edwards read a "Report upon a specimen of *Anemone nemorosa* infested by a fungus." This fungus is a species quite common both in this country and Europe, upon the true leaves of the Anemone in early spring, and has been named *Puccinia anemones*. In Ray's "Synopsis" (Third Edition, 1724) it is described in company with true ferns, and it was for a long time supposed that the deeply cleft leaf of the Anemone, with the brown spots upon its under side, was a fern with sori. As Ray says, "this capillary was gathered by the Conjurer of Chalgrave," hence it has come to be known as the Conjurer of Chalgrave's fern. This fungus, like the other microscopic parasitic ones, grows beneath the surface of the plant, throwing out its threads of mycelium among the cells, until it develops the brownish coloured bodies, known as spores (perhaps incorrectly), and it is by the peculiar characters of these that species have been distinguished, although there seem two good reasons for supposing that these plants are not only dimorphous, as has been stated, but polymorphous, assuming different forms according to the habitat in which they are found. In reply to the question as to whether it was true, as was stated by farmers, that barberry bushes infested with fungus or mildew, conveyed that mildew to fields of wheat adjoining, which then showed the presence of "brand," Prof. Edwards remarked that such might very likely be the case, as very little certain is known respecting the life history of these minute plants, and he was now carrying on some experiments, by infesting different plants with fungi taken from others, so as to see if the host which they inhabited modified their characters materially. He described and illustrated, by means of diagrams, the characteristics of the wheat brand, *Puccinia graminis*, and other fungi, and expressed a hope that the botanical members would contribute specimens of such plants as they found to be infested by mildews, brands, and smuts, for the Society's collection.—The President made some remarks on the existence of human remains in caves in this country, in continuation of his communication at a recent meeting. He alluded to the well-known cave at Carlisle, Penn., which has been very carefully searched by Prof. Baird, of the Smithsonian Institution, whose investigations would be, it was hoped, shortly published. Besides the human remains there were found many of various mammals identical specifically with those now or lately living in the vicinity. But one remarkable fact had been developed—viz., that in every case they were at least one quarter larger in dimensions, so that these particular animals at least would seem to have degenerated in size during the lapse of time. Thus, for instance, numerous remains of foxes were found, having characters identical with those now living with the exception of the size. Prof. Shaler's explorations at Big Bone Lick recently, had also brought to light facts of great interest, which showed that the deer and buffalo were comparatively new comers upon this portion of the continent. He (Dr. Newberry) had found the bones of a buffalo on the west side of the Rocky Mountains, although they were not to be seen living there at the present time. The Indians of that district had traditions of the buffalo existing there at a recent period, all of which illustrated the change of fauna which had been for a long time and still was taking place upon this continent.—Prof. O. W. Morris read an "Abstract of the comparative meteorology of the month of March, for the years 1869 and 1870, and of the month of April, 1870," showing that in 1869 the lowest daily mean for March was 13·76°, and for 1870 it was 24·80°, or 11·04° higher. The mean temperature for March 1869 was 34·10°, and for 1870 it was 35·55°, or 1·45° warmer. The mean of the barometer for March 1869 was 29·834 in., and for 1870 it was 29·772 in. The mean humidity for March 1869 was 49·50°, and for 1870 it was 54·85°. The month of March 1870 was thus shown to be warmer than in 1869, the barometric pressure was a little less, and the humidity greater, although there was not so much rain. March 1870 kept up its old reputation as the "windy month." He also quoted from tables, prepared to show some other important facts in meteorology. Thus, examination of the records kept for the last sixteen years (1854-69, both inclusive), shows that the temperature during that time did not vary much, as the mean for the sixteen years is 52·60°, giving eight above and eight below the mean, and a range of 7° only, 1859 having the highest mean (55·66°) and 1868 the lowest (48·67°). The year 1869 was 1·1° below the average; the maximum of 1869 was nearly that of 1855; the minimum was greater than that of any in the series, being 85° above zero, while nine of the years it was below, and in 1866 it was 13° below, and in that year also the thermometer rose to 98·8°, the highest in the series. He also read from abstracts of the temperature, &c., kept by C. Bogert, in New York City, from 1816 to 1853.

BOOKS RECEIVED

ENGLISH.—A Class book of Inorganic Chemistry: D. Morris (Philip, and Son).—Clavis Agaricinorum: W. G. Smith (L. Reeve and Co.).—The Great Sewage Question: W. Justine (J. R. Day and Co.).

FOREIGN.—(Through Williams and Norgate)—Berichte über die Fortschritte der Anatomie u. Physiologie im Jahre, 1869; 2tes Heft (Henle Meissner, and Grenacher.)—Die Lehre von den Tonempfindungen: H. Helmholtz; 3te umgearbeitete Ausgabe.—Schmetterlinge Deutschland's und der Schweize: H. v. Heinemann.—Etude sur le Calendrier Copte et ses éphémérides: E. Tissot.—Traité d'histologie et d'histochimie: Frey, Spillmann, et Ranvier.

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