THURSDAY, APRIL 20, 1916.

GEMS AND SUPERSTITION.

The Magic of Jewels and Charms. By Dr. G. F. Kunz. Pp. xv+422. (Philadelphia and London: J. B. Lippincott Co., 1915.) Price 21*s.* net.

DR. KUNZ, who is well known as a mineralogist of repute and as one of the leading authorities of the day on precious stones and jewelry, has evidently spared no time and trouble to make himself acquainted with the many strange fancies and superstitions that have at various times and in various countries been attached to gems and other treasured objects. As the result of his industry he had compiled a large mass of notes, out of which he gave us barely two years ago a book entitled "The Curious Lore of Precious Stones," and now, since his stock of material was by no means exhausted by the publication of that work, he sets before us a companion volume, or, as he terms it in his preface, the twin sister, the scope of which is much more diffuse; precious stones enter again, especially as regards their curative and talismanic uses, but besides them we find also substances which do not ordinarily figure in jewelry, such as meteorites, fossils, bezoars, and animal concretions. Founded as it is upon notes, and copiously sprinkled with lengthy extracts from the original literature, the book proceeds with something of the jerky gait of the grasshopper, and we find nothing in the way of a general discussion or the development of some comprehensive theory. Nevertheless, the author has done good service by providing a good and convenient *résumé* of the subject, and not the least valuable and interesting paragraphs are those in which he gives the results of his own observations.

In the first chapter, on magic stones and electric gems, the author touches upon some curious stones. He considers that galactite, which according to Pliny came from the Nile and had the colour and odour of milk, was not, strictly speaking, a stone at all, but nitrate of lime. Rain-makers, who professed to produce rain by their magic art, seem to have made use of any unusual stone that happened to come to hand, and, although rock-crystal has been so employed, transparent stones were by no means the rule. In medieval times countless attempts were made by the alchemists to discover the so-called philosopher's stone, which should transmute base metal into gold, and the ignorant people of those days were often successfully imposed upon. A description is given of the most striking examples of the supposed transmutation that have come down to us, viz., the large medallion, bearing in relief the heads of the Emperor Leopold and his ancestors of the house of Hapsburg, which was treated by Seiler in 1677, and the exceedingly rare medal struck in 1647 by command of the Emperor Ferdinand III. from gold supposed to have been produced in his presence by Hofmann; in neither case, of course, is the metal pure gold, but it remains a mystery what was the actual process, the historical interest of the objects precluding a chemical examination. The remarkable electric properties of tourmaline, in which respect it transcends other minerals, first attracted notice as early as 1717, and were definitely established by 1756. Dr. Kunz describes in appreciative terms the beautiful examples of this mineral that have come from Brazil and California, and bases upon them somewhat extravagant symbolism; thus as regards the "peace stones"—the well-known tourmaline crystals, red and green at opposite ends with a colourless band in the middle—he writes: "We can see symbolised in them the great and consoling fact that, however marked may be the differences between any two peoples, they need not be cause for enmity, but may instead become true and enduring sources of peace and bonds of union." The electric properties of amber were, of course, a much earlier discovery, dating back to 600 B.C. That the wearing of a necklace of this substance kept off attacks of erysipelas in a person subject to them was maintained by the late Rev. C. W. King, the well-known writer on precious stones; the author quotes his actual words: "Its efficacy in defence of the throat against chills is evidently due to its extreme warmth when in contact with the skin and the circle of electricity so maintained."

In the chapter on meteorites the author draws for his description of the earlier falls largely upon Chladni, who was the first writer to make a systematic study of the numerous traditions of such phenomena, and to suggest a doubt in the minds of the scientific world whether they should be dismissed as idle fables. The more famous of the historical stones include the Phrygian stone, which was conveyed to Rome in 204 B.C., the Diana of the Ephesians "which fell from Jupiter," the Kaaba stone at Mecca, and the stone which fell at Ensisheim in Alsace on November 16, 1492. We note that Dr. Kunz speaks of the collection of meteorites at Vienna as the finest in the world, which is possibly true, but we may remark that the one in the Natural History Museum, London, is practically equal to it, and contains the large Cranbourne stone, weighing about 3½ tons. Descriptions and illustrations are given of the three enormous masses discovered by Admiral, then Lieut., Peary in 1894 near Melville Bay, West Greenland, and a few years subsequently removed by him to the American Museum of Natural History, New York, weighing respectively 36½ tons, 3 tons, and 1100 lb.; they have been named the Ahnighito, the Woman, and the Dog.

It may strike many readers as strange to read that even as late as the middle of the eighteenth century powdered hard stones were still in use for medicinal purposes; thus in a druggist's price-list dated 1757 a pound of emerald is quoted at eight groschen (5*l.*), of sapphire at double, and of ruby at treble that amount. The author gives lengthy details of the supposed virtues of the various gem-stones, the species being arranged in alphabetical order, and devotes a couple of chapters to the

curative properties of fabulous stones, and of the mysterious bezoars, which were thought to have originated in the eyes of deer, in the liver of various animals, or in similar strange ways. The use of precious stones in religious ceremony goes back to a very early date, and still prevails. The instance of the High Priest's breastplate of the ancient Jews is well known, and identification of the stones composing it has given rise to much interesting discussion. A long chapter is devoted to the description of amulets in ancient and modern times, and in the concluding chapter Dr. Kunz has collected many strange stories about precious stones. As an unusually brilliant imaginative effort we may select the old Burmese legend of the origin of the famous ruby mines: "In the first century of our era three eggs were laid by a female *naga*, or serpent; out of the first was born Pynsacoti, a king of Pagan; out of the third came an Emperor of China; and out of the third were emitted the rubies of the Ruby Mines."

The book is superbly illustrated and well printed, and contains an adequate index.

A BIOGRAPHY OF EDISON.

Thomas Alva Edison. By F. Rolt-Wheeler. Pp. ix+201. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1916.) Price 2*s.* net.

IN this life of Thomas Alva Edison, the author has given a very interesting description of the childhood, youth, and manhood of America's —one might almost say, the world's—greatest living inventor. We learn that, as a boy, Edison proved unsatisfactory under school routine, but was a great success under his mother's private tuition. He incessantly asked questions on and about everything, and insisted on an answer or wanted to know the reason "why." He also showed, from the earliest records, that he was a keen thinker, worker, and planner on all work which interested him, but under "routine" of any kind he was a complete failure.

The account of Edison as a newspaper boy on the Grand Trunk Railroad, and his original methods of disposing of his papers, as well as the description given of his services as a telegraph operator, illustrate the extraordinary ingenuity of the youth. He seems to have an uncanny foresight or "guessing power," as he calls it. He is no mathematician, and declared "he could guess a good deal closer than they could figure." In later years, as he developed his inventions one by one, he collected a number of valuable and enthusiastic assistants. He inherited from his father an exceptional power of gaining the confidence of people in his work and their financial support.

Edison's first important invention was the vote-recorder, which he placed before Congress men, who examined and acknowledged that it was a great success, but thought it was not required. This was a severe shock to the inventor, who at the time was hard up for money and hoped to make something out of it. But it taught him a lesson; "for there and then he made up his mind never to waste time in inventing things which were not wanted." Later he became manager of the Law Gold Recording Company, and invented many improvements on their instruments. At this time he married, but he denies the story that "he forgot his wife an hour after his wedding." He later became connected with the Western Union Telegraph Company, which gave him every help in completing his inventions. Among these are the duplex and quadruplex telegraphy, also the telephone carbon transmitter, and numerous other inventions well known to all.

On one occasion Edison was asked, "What is a genius?" and his answer is well worth repeating. "A genius is about 2 per cent. inspiration and 98 per cent. perspiration." His part in the construction of the carbon filament lamp (which was not entirely his work, for the late Sir Joseph Swan had much to do with it) is well known, as also in the production of the phonograph, which may be considered the most wonderful of all his inventions, and will always be associated with his name. Of his recent inventions, the storage battery is of enormous importance, especially to England at the present time. It is impossible to give more than a rough impression of his wonderful energy and enthusiasm and his determination to master all problems. America and the world are richer and wiser for his genius; and though he is now sixty-seven years of age, we hope that he will not only reach, but also pass, in activity, the great ages of his father and grandfather.

S. G. BROWN.

THE DESIGN OF DIESEL ENGINES FOR MARINE PURPOSES.

(1) *Land and Marine Diesel Engines.* By G. Supino. Translated by Eng. Lieut.-Commander A. G. Bremner and J. Richardson. Pp. xv+309. (London: C. Griffin and Co., Ltd., 1915.) Price 12*s.* 6*d.* net.

(2) *Diesel Engines for Land and Marine Work.* By A. P. Chalkley. Fourth edition, revised and enlarged. Pp. xvii+368. (London: Constable and Co., Ltd., 1915.) Price 8*s.* 6*d.* net.

JUDGED from the titles given above, it might be supposed that these two recently published treatises on the Diesel engine covered the same ground, but a careful perusal will show that the ideas of the authors are by no means identical, and as a result it may be predicted that although both volumes will appeal to all engineers and others who have to do with internal combustion motors and motive power for the propulsion of ships, the first of the above two books is one that will find its way into the reference department of every drawing office where Diesel engines for marine purposes are being designed, whilst the second book, by means of its description of the gradual development of the Diesel engine from the early experimental engines of Dr. Rudolph Diesel down to the modern practice of to-day, will appeal

more to the student of heat engines and the prospective user of this particular type of prime mover.

(1) The keynote to the first volume is undoubtedly the explanation of the actual designing of the marine Diesel engine and its component parts, and it seems quite wonderful that modern practice has so rapidly become to a large extent standardised. The translation from the original has evidently been undertaken by engineers skilled in the practice of their profession and in sympathy with the subject-matter of the text. The original treatise is the work of an Italian specialist in the development of the Diesel motor, Giorgio Supino, whose early decease is a real loss to Italian engineering. Naturally the reader will ask what has this eminent foreign author to say about British-made Diesel engines and British manufacturers; at the end of part i., page 72, is a table giving a list of ships and the types of engine adopted, viz., high speed, low speed, 4 cycle, and 2 cycle, and it is noticeable that one only out of some twenty names is that of a British firm.

This surely is a matter which vitally concerns a manufacturing country such as ours. Recollections of the early years of the petrol motor and motor-car industry and a comparison with the state of our present manufactures makes one devoutly hope that history will repeat itself and that full advantage will be taken of the experience and experimental labours of our Continental competitors, so that the supply for our colonies may come from this country. No discussion on the merits of Diesel engines can be entered upon without reference to that class known as semi-Diesel, which latter are perhaps better termed hot-bulb engines. It is good to think that our output of these is more satisfactory, but the magnitude of the units employed of this class is small compared with that of engines of the Diesel type. It is also good to remember that the engine called semi-Diesel is in reality the direct outcome of the work of an English engineer, Mr. Stuart Akroyd, whose name is associated with the firm of Messrs. Hornsby and Sons, Ltd., in the production of the Hornsby-Akroyd engine, and it would therefore seem a better name for this type of engine that it should be termed "engines working on the Akroyd cycle," rather than "semi-Diesel."

A brief review of the first book shows that part i. deals with a general survey of the types of oil engines in general use, with a discussion on efficiencies. Chapter vi. gives methods of calculating cylinder dimensions; this is succeeded by chapters dealing with the designs of various parts, such as bed-plates, crank cases, engine framing, crank-shafts, pistons, cylinder heads, valves, fuel injection and regulation, etc., all very clearly illustrated by excellent drawings and plates. Methods of reversing marine engines give up-to-date practice, and it is startling to realise that the whole cycle of reversing can be performed in 12 seconds. A final chapter deals with trials and tests of Diesel engines. It would be a help if a tabulated form of "report on a trial" were included, as standardisation is very desirable in any form of comparative tests. From this short review it would appear that the subject-matter is really the complete design of Diesel engines for marine purposes, and as such it is a meritorious addition to engineering literature.

(2) The second volume is a greatly enlarged and much rewritten edition of a work which first appeared in the spring of 1912, almost contemporaneous with the last public appearance of Dr. Diesel in London. The defects of the first edition (which bore traces of hurried preparation) have disappeared, and we now have a copiously illustrated and enthusiastic survey of the progress of the Diesel engine, with many examples of modern types for land and marine installations, and an optimistic claim for its future development as the prime mover for mechanical transport. In this volume are upwards of forty-five folded plates, which give the main dimensions and cross-sections of the chief types of engines constructed. It is satisfactory to note that British types figure more prominently in this book. One of these, viz., the Tanner-Diesel, is shown on page 264. The writer remembers the early struggles of Mr. Tanner to get his designs taken up, and is glad to pen this tribute to his faith and earnestness in carrying through his designs to a successful issue in the face of great difficulties. It will be noticed that the progress made in the last four years has been mainly in the development of the two-stroke cycle type, and the increase of h.p. developed per unit employed. A perusal of the table on page 317 shows that the maximum diameter of cylinder is now 30 inches, and that the maximum h.p. per cylinder is 650 for a 2-cycle engine, but the average h.p. per cylinder is only 230 for this class, and for the 4-cycle slow-speed type the average is only 125 h.p. per cylinder, a figure which represents the performance of the *Selandia*, the boat Londoners had a chance to inspect whilst she was lying in the Thames in 1912. The figures given justify the claim of the author of this book that the 2-stroke cycle is that of the future. To the student and others who desire to understand this engine and its working this volume will be of great service.

It would be interesting to refer to the development of the Diesel engine and its use to extend submarine warfare, but the present is not opportune for any remarks on this point. A. J. M.

OUR BOOKSHELF.

Instincts of the Herd in Peace and War. By W. Trotter. Pp. 213. (London: T. Fisher Unwin, Ltd., 1916.) Price 3*s.* 6*d.* net.

AN interesting and useful sociological survey. The author contends that the subject can really become a science, practically useful by conferring foresight. It is not necessarily only a mass of dreary and indefinite generalities, but may become a guide to the actual affairs of life, giving an understanding of the human mind which may en-

able us to foretell some of the course of human behaviour. The war brings the chance of testing the truth of this suggestion. It is becoming, obviously, more and more a war of moral forces; and an understanding of the nature and sources of national *moral* must be as important a source of strength as the knowledge of the military engineer.

The author proceeds to discuss the various forms of gregariousness, and finds the British form typified by the bee, the German form by the wolf. The difference is so great that the war is not so much a war between nations as a war between different species. Nature is making one of her great experiments; is setting herself to try out the strength of the socialised and the aggressive types. To the socialised peoples she has entrusted the task of proving that her old faith in cruelty and blood is at last an anachronism. To try them, she has given substance to the creation of a nightmare, and they must destroy this werewolf or die. And a calm consideration of the German and the British mind leaves us in no doubt where the strength lies. In Britain there has been no Hymn of Hate, no "God punish Germany!", no gospel of bluster and frightfulness. These are symptoms of lupine rage. But Britain, fighting for existence and for honour, has quieter and deeper vision; and she will not sheathe the sword until her task is done, and a peaceful Europe once more possible, freed from the terror of imminent wanton attack by an aggressive Power.

British Fungi and How to Identify Them. By J. H. Crabtree. Pp. 62. (London: C. H. Kelly, n.d.) Price 1s. net.

OUR native fungi afford beautiful objects for the photographer, and have been well illustrated in the many popular and scientific works which deal with them. In the little book before us Mr. Crabtree illustrates some forty different species of well-known fungi by means of very good photographs, and each photograph is accompanied by a page of useful descriptive text. By the aid of both text and illustration a particular fungus should be able to be identified without much difficulty. In the case of the somewhat small differences between certain edible and poisonous fungi the ordinary photographic reproduction is not sufficiently clear to show the distinguishing features, and a few good colour prints would have been of value.

In a short introduction of four pages the author gives a concise account of the larger fungi in general—with which only this little book is concerned—details as to the spore-arrangement, etc., and a simple classification. It is unfortunate that Mr. Crabtree's frontispiece, "An unnamed fungoid growth found upon a tree," is not a fungus at all, but is what is known as a "wood flower." This hollow woody growth has been gradually formed about the suctorial portion of some parasitic plant, probably a Loranthus, which has become detached and has left a large tulip-shaped woody scar resembling a fungus on the branch of its host plant.

LETTERS TO THE EDITOR.

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

The Primary Sugar of Photosynthesis.

MICROCHEMICAL tests on the assimilating cells of several plants indicate a considerable concentration of hexoses in the chloroplasts, or in the protoplasm immediately surrounding them. Other lines of experiment suggest that while sucrose is concentrated in the large vacuoles, invertase is held apart from it in the protoplasm.

These facts force upon one the possibility that the pioneer analytical work of Brown and Morris established and extended by Parkin and by Davis and his collaborators, does not after all necessitate the conclusion that the formation of sucrose is a preliminary step to the production of hexoses in the leaf.

It seems more probable that the hexoses are formed from formaldehyde in the chloroplast, and, when their concentration reaches a certain limit, condensation into sucrose due to invertase, or some saccharogenic enzyme, takes place. The sucrose thus formed is passed into, and stored in the vacuole. As the volume of the protoplasm available for the hexoses is small compared to the space allotted to the sucrose, the increase of the total percentage of hexoses will be small when the leaf is exposed to light, while that of the sucrose will be large. Consequently the rise of sucrose on illumination shown in analyses of leaves is not a cogent argument for regarding it as the primary sugar.

The recognition of the localisation of various substances in the cell also supplies an explanation as to how the sucrose-hexose ratio of the cell is maintained in presence of invertase. The absence of invertase from, and the storage of sucrose in the vacuole may be compared to the conditions obtaining in the root of the sugar beet. Only there, of course, the source of sucrose is secondary hexoses. In photosynthesis the condensation of the sugars is probably determined by the fact that for the same rise of osmotic pressure in the vacuole twice the amount of the disaccharide may be stored. When the limiting pressure is reached in this way the condensation of hexoses to starch may give extended elasticity to the economy of the cell.

HENRY H. DIXON.
THOMAS G. MASON.
School of Botany, Trinity College, Dublin,
April 10.

Isle of Wight Disease in Bees.

DRASTIC recommendations regarding the disinfection or destruction of combs, hives, and appliances which have come in contact with bees infected by Isle of Wight disease have been made by the Board of Agriculture, and were repeated in an article in NATURE of March 2 (p. 7). The recommendations are founded upon the idea of the infectiousness of the disease, and are intimately connected with the recognition of the protozoon *Nosema apis* as the cause of the disease, and with the knowledge of the ease by which this parasite can be disseminated by infected bees. On account of the practical importance of the subject, I would direct attention to the results of experiments bearing upon these points, carried out by Mr. J. Anderson and Dr. J. Rennie, of the North of Scotland College of Agriculture and University of Aberdeen respectively, and communicated at a recent meeting

of the Royal Physical Society. As an account of the observations and experiments, which were numerous and detailed, will appear in the next part of the Proc. Roy. Physical Soc., an indication of their bearing is all that is necessary for the present.

(1) As regards *Nosema apis*, the authors have been "unable to recognise any causal relation between the presence of this parasite and the disease." Healthy stocks with no signs of disease have been found to be heavily infected by the protozoon, and that over prolonged periods. Numerous stocks have exhibited unmistakable symptoms of Isle of Wight disease, and yet no trace of Nosema has been found in them. This was markedly the case in the Deeside outbreak. Lastly, deliberate infection of a stock with Nosema did not produce the recognised symptoms of the disease. "Nosema may be a contributing weakening factor, favouring in certain cases the development of this disease, but we have not found that it is an essential factor."

(2) As regards the infectiousness of Isle of Wight disease: If it be allowed that Nosema, with its readily transported spores, is not the prime cause of the disease, the supporting evidence of infectivity is weakened, and the direct evidences must be examined more critically. The authors have watched in detail the natural course of Isle of Wight disease in three independent localities, and have followed the history of untainted swarms placed in contaminated hives and fed on contaminated honey. They have found no indubitable evidence of the infectiousness of the disease, although the indications seem to be that it is "probably infectious"; but in any case they are assured that it is "not necessarily conveyed by mere contact with contaminated hives or combs, or by feeding upon contaminated stores."

It is a point of some interest and importance that, on account of the unsatisfactory nature of experiments on a small scale in artificial conditions, the above results are based on observations and experiments upon hive bees living in natural conditions.

JAMES RITCHIE,
(Hon. Secretary, Royal Physical Society).

Edinburgh.

REGARDING Dr. J. Ritchie's communication, it would seem well to await the published paper of Messrs. Anderson and Rennie before making detailed remarks. Also, as Dr. Ritchie is not the direct author of the paper, it is inadvisable to bring in a third party. However, it is most surprising, to say the least, to learn that "Isle of Wight" bee disease is not considered to be infectious. How, then, has the disease spread all over Great Britain and most of Ireland during the last ten years? The statement of the non-infectivity of the disease is emphatically inaccurate. Dr. Ritchie writes of the "unmistakable symptoms" of the disease. But, what are the characteristic symptoms? The investigators working under the Board of Agriculture, in their reports of 1912 and 1913, showed conclusively that there were no well-marked differential symptoms of "Isle of Wight" bee disease. This was also pointed out in my article in NATURE, and the reason for this is obvious, namely, the limited range of expression of the bee, as was also mentioned in my article. Of the workers contributing to the reports of the Board of Agriculture, two were bacteriologists, two were protozoologists, and one was an expert bee-keeper. Many field experiments as to the pathogenicity of *Nosema apis* were conducted, and the investigators were unanimously of the opinion that "Isle of Wight" bee disease is microsporidiosis. Apparently Dr. Ritchie and Messrs. Anderson and Rennie have quite overlooked the importance of parasite carriers, a subject which was carefully pointed out in my article and in the Journal of the Board of Agriculture, Supplements Nos. 8 and 10. Healthy carriers of most parasitic diseases are known.

As to "drastic recommendations," the simple elements of sanitation only were suggested, about which there can be no dispute. The destruction of hives was not suggested in my article. Regarding the experiments of Mr. J. Anderson and Dr. J. Rennie, there is no statement in the above letter as to what stages of *Nosema apis* were used by them.

These remarks must suffice for the present. My article was written after ten years' personal investigation of "Isle of Wight" bee disease, in nearly every part of Great Britain. Judging from Dr. Ritchie's letter, the paper of Messrs. Anderson and Rennie appears to contain little but negation. F.

Preventive Eugenics.

THE writer of the valuable article in NATURE of April 6, on the report of the Royal Commission on Venereal Diseases, has given it the title of "Preventive Eugenics," a term for which I am responsible, defining it as "the protection of parenthood from the racial poisons," by which latter I mean all such agents as, injuring the individual, injure also the next generation through him, or her, as parent.

Syphilis is, of course, an example of a racial poison, and your writer's protest against the term "hereditary syphilis" is most welcome to one who has made such protests for many years. As Dr. J. W. Ballantyne has said, the term is "an insult to heredity." It indicates the persistent medical and popular blindness to the ante-natal stage of human life. All syphilis is acquired syphilis, an infection of which the date may be ante-natal, when we inexcusably call it "hereditary," or post-natal, when we call it acquired, the fact being too obvious for even the "idols of the forum" to obscure. The Commissioners should have condemned the false term, and used "ante-natal syphilis" instead.

The point is not only academic. Eugenists who have had no medical, much less obstetrical, experience, unaware of the fallacy involved, have assumed much infant mortality to be due to bad heredity, and thus to be an instance of natural selection, when, in fact, ante-natally acquired infection of syphilis was responsible. This grave error is involved in the biometrical publications on infant mortality throughout, and has long discouraged the efforts now being made, at last, to save the infants who are our national future.

C. W. SALEEBY.

Royal Institution, W., April 8.

Atmospheric Electricity.

IT would be interesting to know if any reader of NATURE has made observations similar to those made here on the afternoon of April 14.

A large thundercloud was just passing off in the east without having produced any obvious thunderstorm phenomena. The sky overhead was occupied by cirrus, while a second thundercloud was coming up in the west. It was found that sparks, one of them certainly reaching 2 or 3 mm. length, could be drawn from the metal of a Besson comb nephoscope, supported on a wooden stand, with the comb at a height of $3\frac{1}{2}$ metres above an asphalt roof (itself 12 metres above ground), on which observer and nephoscope stood. The leaden roof of a wooden cistern casing yielded similar results, but the most surprising observation was that a Campbell-Stokes sunshine recorder, bolted and cemented to a concrete parapet extending about a metre above the asphalt, also gave

quite appreciable sparks during the period of activity. The charges took fifteen or twenty seconds to build up after discharge, and the experiment was repeated very frequently.

The second thundercloud produced two peals of thunder and a slight shower, soon after which the abnormal electrical conditions ceased to manifest themselves, about three-quarters of an hour after they were first noticed. R. A. WATSON WATT.

Meteorological Office, South Farnborough, Hants, April 15.

The Influence of Tides on Wells.

REFERRING to Mr. Jas. Kewley's letter in NATURE of April 13, it is not unusual for the water in wells to rise and fall with the tides when such wells are near the sea. But is it necessary to assume that the phenomenon is due to the weight of the incoming tide compressing the underlying strata, as suggested by Mr. Kewley? Surely it may be sufficiently explained on the assumption that as the rising tide is a rising head of water it, without necessarily compressing the rocks beneath, tends to compress the air and replace the less dense fresh water included in the interstices and fissures, thus affecting the water-level of any contiguous well. In this connection may I direct attention to a letter of mine on "Tidal Action of the Earth's Crust," published in the *English Mechanic*, June 11, 1909? CECIL CARUS-WILSON.

PHYSIOLOGY IN THE WORKSHOP.

IN the never-ending struggle between capital and labour, or rather between employers and workmen, the points of dispute have been largely concerned with the hours of labour and wages, the employers trying to obtain as long hours for as low wages as possible, while labour has struck for a shortening of hours with increased wages. Labour is thus regarded as a commodity, to be bought as cheaply and sold as dearly as possible.

In most of these disputes it would seem that both sides have lost sight of the fundamental conditions of their own prosperity. It is, after all, of little account to the employer that he should be able to buy cheaply so many hours of other men's lives. The only factor which really concerns him is that he should be able to produce as large a quantity of his goods as possible at as small a price as possible, reckoning both rent of capital and cost of labour. An implicit assumption seems always to be made that the more hours of a man's life the employer can buy for a certain sum, the cheaper will be his cost of production. But labour also is concerned in the cost of output. It is a truism that when business is slack, *i.e.* when the profits are small, strikes are few and far between, the workers recognising that it would be better in many cases to close down works than to give them increased wages. Both employers and workmen are therefore concerned that the industry in which they are engaged should be as prosperous as possible, *i.e.* that production should be as cheap and rapid as possible. To this end both parties should co-operate. The only divergence of view which is reasonable should occur later when the question arises of the division of the profits, *i.e.* as to how much should be assigned to labour and how much for management and rent of capital.

Both sides are therefore interested in the efficiency of labour and its use to the best possible advantage—the employer in order that he may obtain as great a production at as small a price as possible; the workman that he may be able to earn enough to keep himself in comfort, while allowing some time in the day or week for recreation and the enjoyment of life.

It is remarkable how little attention has been paid in this country to the problem of how to use labour to the best possible advantage. The appearance of a Memorandum on "Industrial Fatigue and its Causes" (Cd. 8213, Wyman and Sons, Ltd., price 1½*d.*), which has been drawn up and issued by the Health of Munition Workers Committee, is therefore of extreme importance at the present time, since its object is to point out the only method by which increased efficiency of production can be attained.

In this pamphlet it is shown that the problem of scientific industrial management is fundamentally a problem in industrial fatigue. For the continued efficiency of an animal or man, rest must alternate with work, and the periods of rest and work must vary with the type of work involved. This elementary principle is acted upon generally in our management of horses. The report is a plea for its application also to the case of man. We cannot get the utmost possible work out of man or horse unless this principle is taken into account. We have thus to determine in the case of man what are the maximal efficiency rhythms for various types of work and workers. For work in which severe muscular effort is required it seems probable that the maximal output over a day's work and the best conditions for the workers' comfort and maintained health will be secured by giving short spells of strenuous activity broken by longer spells of rest, the relative amount of time devoted to resting being greater than in employments in which nervous activity is more prominent or more complicated.

The truth of this statement is well illustrated by an anecdote recorded in the Memorandum before us. Two officers at the front competed in making equal lengths of a certain trench each with an equal squad of men. One allowed his men to work as they pleased but as hard as possible. The other divided his men into three sets to work in rotation, each set digging their hardest for five minutes only, and then resting for ten until their turn came to dig again. The latter team won easily. Another instance is that of a munitions factory, where men engaged in the severe work of moulding were required to rest fifteen minutes in every hour of work. The men objected to this long spell of rest in each hour because the work was piecework, so that the manager had to make the hourly rest compulsory and appoint a foreman to see that the regulation was complied with. As a result of this the output per hour was found to be actually increased.

It is evident that the optimum working rhythm for each kind of work can only be determined by

observation and experiment, and it is pointed out that since the true sign of fatigue is diminished capacity, the measurement of output gives the most direct test of fatigue, and thereby also serves as a criterion of success in devising conditions of work which shall avoid fatigue.

No works manager should consider that the conditions of work are satisfactory in his factory or department simply because these conditions have been observed for many years. Progress can only be attained by the constant maintaining of an experimental attitude of mind and the actual institution of experiments in the conditions of work themselves. Such measurements of output should be recorded for groups of workers as well as for the individual worker. Information on individual output is often valuable. It may reveal the adoption by certain individuals of particular habits of manipulation which tend to avoid fatigue, and may then be taught to the other workers. Moreover, these tests of individual capacity give an opportunity of rearrangement of workers and their assignment to jobs for which they are particularly fitted. It is mentioned that astonishing results, bringing advantage both to employers and employed, have been gained in other countries by the careful selection of individuals for particular tasks, based not upon the impressions of foremen, but upon the results of experiment.

We gather from the report as a whole that in nearly all cases the hours of labour have been too long. This is especially marked in the stress brought about by the present war. This undue lengthening of hours causes not an increase, but a diminution of output, and gives rise to staleness and a state of lethargy and indifference often accompanied by a craving for change and excitement, for which in some cases alleviation may be sought in the undue use of alcohol.

The Committee points out the necessity for a co-operation of the workers with the management in experiments to determine the optimum relations of spells or shifts of work to rest intervals and to holidays. They remark that it is not surprising that a tradition of slowed labour has arisen among workers as a kind of physiological self-protection against the excessive hours of work which have been imposed upon them—hours which are in excess of those suitable for maximal efficiency. This tradition of slacking will make a real difficulty in the endeavour to improve the workers' conditions while maintaining or increasing output. Thus it is mentioned that in one factory, a shop staffed entirely by new hands after six months produced 13,000 articles per week as against the 5,000 for which the sheds were designed. This output was not approached by the older hands in the other shops. Apparently it is not easy to change a customary rhythm of work which has been imposed automatically as a method of unconscious self-preservation.

In view of the necessity for periods of rest, it is not surprising to find that the Committee unreservedly condemn the practice of working without a Sunday rest, or, at any rate, one day's rest in the seven. They quote one foreman to the effect that Sunday work gave "six days' output for seven days' work on eight days' pay." Here again the Sunday was a period of slacking, necessary for the continued work of the men, but a pure waste of time so far as the management was concerned.

It is impossible in this notice to give an adequate account of the sound reasoning contained in this Memorandum. We may only hope that it will be read and digested by employers and labour leaders alike. Only by their co-operation along scientific lines can we expect to hold our own and rebuild our financial position in the acute commercial and industrial struggle that will follow this great war. E. H. S.

THE SHORTAGE OF DYESTUFFS.[1]

THE Society of Chemical Industry has recently issued a reprint of five papers read before its New York Section on the manner in which the United States is dealing with the shortage of dyestuffs. These papers are of particular interest in view of the general similarity presented by the industrial problem in Great Britain and in the States. In both countries the legal profession "governs," in both the scientific "expert" finds an easy prey in a wealthy but uninformed investing public, and in both industrial development is heavily taxed by parasitic professions which add nothing to the national store of wealth, knowledge, and productiveness.

Under these conditions the United States, like Great Britain, has become largely dependent upon Germany for her supplies of fine chemicals, and the reprint under consideration indicates that much the same remedies for this pathological condition are suggested in both countries. Dr. E. E. Pratt tells again the well-known tale of the sale of European aniline under cost price in America for the purpose of killing the Benzol Products Company, and several writers refer to the possible danger of "dumping" after the war and to the necessity of legislative prevention of this operation. Dr. T. H. Norton, whilst indicating the determination of American industrials to build up a native manufacture of coal-tar products without prolonged discussion of tariff issues, is perhaps weak in suggesting that useful assistance may be obtained from the Swiss firms; America is surely possessed of so much natural talent and self-reliance as will suffice for the establishment of a national industry without foreign help. Dr. Norton, however, makes one suggestion which seems novel, and which we should do well to act upon, not so much in the interests of the colour manufacturer as in those of the dyer and consumer; he proposes that the degree of purity and the methods of use of dyestuffs should be standardised by a central bureau. Such a control upon the purity of colours, and also upon modes of application to the various fibres and fabrics, would tend towards economy, would assist in diminishing the unnecessarily large

[1] The Dyestuff Situation in the United States. Journal of the Society of Chemical Industry, December 15, 1915 (No. 23, vol. xxxiv.).

numbers of dyestuffs used, and would hamper the operations of vendors of proprietary, and often comparatively valueless, colour mixtures now offered to the dyer.

Curiously enough, two important topics seem almost to have escaped discussion in the present reprint; very little is said as to how the new American industry is to advance, and as to the way in which a supply of technically-trained chemists is to be obtained. Perhaps it is premature to expect any comprehensive scheme which leads into the unknown future of chemical technical development at a time when the American textile industry is so grievously smitten by the sudden stoppage of dyestuff imports; it is, however, to be noted that the establishment of a coal-tar industry must, to be successful, carry with it the development of many congruent manufactures relating to medicine, photography, and other arts and sciences dependent upon organic chemistry. The other point, as to the provision of technically-trained organic chemists, was merely mentioned by Dr. T. M. Bogert, and with the statement that assistance is required in the shape of grants to universities and colleges.

This latter is a question which has been frequently considered and discussed with us. British Governments and municipalities have expended vast sums for the purpose of aiding the technical industries; whether the expenditure has been justified by the results is extremely doubtful. When any body of teachers, keenly interested and highly competent in its work, feels its activities cramped by lack of funds, and formulates a practical scheme for useful development, it has perforce to pass the scheme on to some higher authority less acquainted with the subject at issue but nearer the source of means. This latter body hands the matter with appropriate explanations to still higher, and ever less learned, authorities until the real, but sublimely ignorant, fountain head is reached and authorises the expenditure of money under conditions which do not necessarily make for efficiency. The required grant is obtained, not by the convincing force of argument, but by the melting power of cajolery. Manufacturers who require technical assistance, and the colleges and universities which are prepared to train the men, must surely learn to rely upon their own efforts rather than upon possible money grants extracted from non-academic governing bodies. Money is undoubtedly required to assist our educational institutions to turn out large numbers of men capable of useful work in the development of our technical industries, but it is questionable whether the present recognised methods for obtaining and using the money are efficient.

In this connection it may be recalled that Dr. W. H. Perkin, the professor of chemistry in the University of Oxford, insisted in his presidential address to the Chemical Society last year upon the necessity for the presentation of a thesis on original research by candidates for an Honours degree in science in our universities. It may safely be asserted that the translation into practice of this view would do more for the development of the chemical industries in Great Britain than all the deputations which have been sent to Cabinet Ministers and all the discussions which have taken place on possible methods of stimulating chemical technology.

W. J. POPE.

THE PROPOSED BOARD OF AERONAUTICS.

AERONAUTICS has, somewhat suddenly, become a subject for public debate, and a serious request has been put forward for an Air Ministry to control the whole of the aeronautical supplies and hand over the products to the Army and Navy. It is perhaps a little unfortunate that the Zeppelin raids occupy so much of the discussion, for the military value of aeronautics in the present war is least evident in the case of the raids.

In order to appreciate the position, it is necessary to realise that the resources of aeronautical industry are not so great that all possible supplies can be obtained fully and quickly. Germany concentrated on rigid airships and obtained a supremacy in airships, whilst the Allies, and particularly Britain, placed their confidence in aeroplanes and gained a supremacy there, which, although not so absolute as that of Germany in airships, is of far greater military importance. Aeronautics is still very young, and is growing rapidly; anyone who, three years ago, had predicted the flight of many hundreds of aeroplanes for several hours of each day of the year would have been looked upon by the general observer as a dreamer. Is it surprising, therefore, that not a single belligerent foresaw what has happened? Without endorsing the claims that the Air Service will ultimately be more important than the Navy or Army, it does appear that the development of aeronautics has already reached a stage at which an Air Board must be contemplated.

Up to the present time the Navy and Army have had independent Air Departments, both of which have made use of private enterprise for the supply of aeroplanes. Experimental work on a large scale has been carried out, and detailed designs of machines proposed for manufacture in quantity have been produced by the Royal Aircraft Factory. The reproduction of machines to these designs has been largely the work of private constructors, who have also made machines to their own design, approved forms of which have been accepted into the Services. Both Air Departments have had the assistance of the Advisory Committee for Aeronautics, a scientific body controlling the aeronautical research at the National Physical Laboratory. A report on the work of this Committee was published annually until the outbreak of war. The organisation outlined above came into existence in 1909, and prepared the way for the extremely rapid growth of aviation in the last two or three years.

Recently a new Committee was formed under the

chairmanship of Lord Derby, the Committee being made up of members of the two Air Departments, the chairman, and Lord Montagu of Beaulieu. The Committee had no executive control in the sense desired by the two non-Service members, both of whom decided to resign their positions. As Lord Montagu indicated a lack of co-operation between the members of the two Air Departments, the resignations produced a general feeling of depression, and to those most keenly interested in the future of aeronautics it has been a relief to find the work of some of the senior members of the Services recognised by promotion. Whatever may be said as to the existing conditions, it seems certain that the extraordinary progress of aeronautics during the war would in itself have been sufficient to raise the question of an Air Board; perhaps the formation of such a Board would facilitate reorganisation. The Government being the only body able to deal with the problem with sufficient knowledge as to facts, the Prime Minister's forthcoming statement will be awaited with considerable interest.

NOTES.

THE Royal Society has elected the following as foreign members:—Prince Boris Galitzin, of Petrograd, head of the Meteorological Service in Russia; Dr. C. L. A. Laveran, of Paris, discoverer (1880) of the parasite (*Laverania malariae*) the cause of malarial fever; Dr. Johan Hjort, director of Norwegian Fisheries; Prof. Jules Bordet, of the University of Brussels, eminent in bacteriology; and Prof. H. Kamerlingh Onnes, of the University of Leyden, the distinguished physicist who was responsible finally for the liquefaction of helium.

SIR RAY LANKESTER informs us that Prof. Metchnikoff, of the Institut Pasteur, is recovering from his serious and prolonged attack of pulmonary inflammation. He is not yet able to go into his laboratory, but is able to occupy himself with some speculative inquiries. He would be glad to know of any well-recorded instances tending to show whether the opinion that men of genius are not usually the eldest born in a family is well founded or not.

THE recommendations of the Royal Commission on Venereal Diseases were dealt with in an article in NATURE for April 6, and the opinion was expressed that the measures proposed by the Commissioners must be approved of without hesitation. It is satisfactory to be able to report that on April 14 Mr. Long, President of the Local Government Board, received a deputation from the National Council for Combating Venereal Diseases, which presented a petition urging the importance of giving effect to the recommendations of the Royal Commission. In his reply to the deputation, which was introduced by Lord Sydenham, Mr. Long said he had communicated with the Treasury, and it is prepared to provide the necessary grant to carry out the recommendations of the Commission with regard to the provision of facilities for diagnosis and treatment. These grants will cover 75 per cent. of the cost incurred by local authorities. It is not proposed to create special hospitals for treatment of venereal diseases, since it is thought that treatment will be carried out more efficiently at existing general hospitals.

A THIRD article on aircraft by M. Georges Prade appears in the *Times* of April 14, and deals with the "Armament of Aeroplanes." It is becoming more and more evident as the war proceeds that the most desirable form of fighting aeroplane is a compromise between the conflicting ideal forms for high speed and convenient gun position. It appears that the practicable weapons are the rifle, machine-gun, and pom-pom, and of these the machine-gun is most frequently used. The position chosen for fighting depends on the field of fire of the machine-gun, which may be fixed relative to the aeroplane, as in the Fokker, or variable, as in most aeroplanes. The machine-gun is commonly mounted so as to fire over the tail, or through a trap-door in the flooring, and it is said that the shot which killed Pégoud was fired through a trap-door. Usually the German aeroplanes do not fire through the propeller, and, when attacking, endeavour to overtake and pass under the hostile aeroplane in order to get into a suitable firing position, but the flight manœuvres during a fight vary considerably from period to period. The Germans have succeeded in using a full belt of 250 cartridges in their machine-gun, but the Lewis gun used by British flyers is said to be the best for aeroplane attack and defence. The pom-poms, firing a small shell an inch or more in diameter, are not yet extensively used, as they call for a larger and more specially constructed aeroplane than that suitable for a machine-gun.

THE issue of the *Scientific American* for March 4 is an "industrial number," dealing largely with the need for the United States to be prepared for the industrial and economic problems which will arise with the declaration of peace. The editor of our contemporary is able to publish a letter upon this subject received by him from the President of the United States. Dr. Woodrow Wilson, writing from the White House, Washington, on February 11, says: "It will be a signal service to our country to arouse it to a knowledge of the great possibilities that are open to it in the markets of the world. The door of opportunity swings wide before us. Through it we may, if we will, enter into rich fields of endeavour and success. In order to do this we must show an effectiveness in industrial practice which measures up to our best standards. We must avail ourselves of all that science can tell us in aid of industry, and must use all that education can contribute to train the artisan in the principles and practice of his work. Our industries must be self-reliant and courageous because based upon certain knowledge of their task and because supported by the efforts of citizens in the mills. If scientific research and the educated worker go hand in hand with broad vision in finance and with that keen self-criticism which is the manufacturer's first duty to himself, the fields will be few indeed in which American commerce may not hold, if it chooses, a primary place."

AN Exchange Telegraph Company message from Paris, dated April 18, states that the Chamber has voted unanimously in favour of the proposal to effect daylight saving by altering the time by an hour, the object being to economise fuel and lighting.

THE council of the Royal College of Surgeons has awarded the Walker prize of 100*l.* to Mr. W. S. Handley, of the Middlesex Hospital Cancer Research Laboratory, for his work in advancing the knowledge of the pathology and treatment of cancer.

THE applications received for admission to Miss E. A. Browne's lecture on "Our Tropical Industries," at the Imperial Institute, on Wednesdays, have been so numerous that no further tickets for Wednesdays can be issued. It has, however, been decided to repeat the lectures on Thursdays in April, May, and

June, at 3 o'clock, commencing on April 27, and tickets for Thursdays may now be obtained at the Imperial Institute.

THE annual meeting of the Marine Biological Association of the United Kingdom was held in the rooms of the Royal Society on April 12. Sir E. Ray Lankester was re-elected president, and Dr. A. E. Shipley chairman of council. The report of the council showed that a considerable amount of valuable research work was still in progress at the Plymouth Laboratory, notwithstanding the loss of staff and difficulties in collecting caused by the war. Experiments on the growth of scales of fishes under different temperature conditions are being carried on, and the regular study of the nannoplankton is continued. The laboratory continues to be used by a number of voluntary workers in addition to the members of the staff.

AT the annual meeting of the Iron and Steel Institute, to be held on May 4 and 5, the following bye-law will be formally moved and voted upon:—"In the event of a state of war existing between the United Kingdom and any other country, or State, all members, honorary members, and honorary vice-presidents who shall be subjects of such enemy country, or State, shall forthwith cease to be members, honorary members, or honorary vice-presidents of the Institute, but they shall be eligible for re-election after the war in the usual manner." The acting president, Mr. Arthur Cooper, will induct into the chair the president-elect, Sir William Beardmore, Bart., and the Bessemer gold medal for 1916 will be presented to Mr. F. W. Harbord.

THE death is announced of Mr. W. W. Cook, a biologist attached to the United States Department of Agriculture, and one of the leading American authorities on bird migration and distribution. In his collection of information on this subject he had especially utilised reports sent to him by lighthouse-keepers.

WE regret to announce the death of Colonel A. E. Barker, professor of surgery at University College, London, and one of the most active and successful of British surgeons. He was in his sixty-sixth year, and died from inflammation of the lungs contracted while on active service abroad on April 8. Born and trained in Dublin, he was appointed assistant-surgeon to University College, London, in 1885, and became professor of surgery eight years later. In more recent years he applied himself with great success to improve the methods of obtaining anæsthesia by spinal injections, and did much to secure a safe means of administration. He improved the technique employed by surgeons in many operations, particularly in those involving operations on the abdomen and on joints. He was a fellow of the Royal College of Surgeons, England, and took an active share in the work of his adopted college and hospital.

THE *British Medical Journal* gives particulars of the career of Sir Thomas B. Crosby, the first doctor of medicine to become Lord Mayor of London, who died at the age of eighty-six, on April 7. Sir Thomas studied at St. Thomas's Hospital, where he filled the appointments of house-surgeon and demonstrator of anatomy. He became F.R.C.S. Eng. in 1860, and two years later M.D. St. Andrews. He was elected Lord Mayor in 1911, being then in his eighty-second year, and it was noted that he was not only the first doctor of medicine but the oldest citizen to receive that office. He attended, as Lord Mayor, at the funeral of Lord Lister on February 16, 1912, at Westminster Abbey, following the pall-bearers in company with the Lord Provost of Edinburgh. He was at one time president of the Hunterian Society, before which he delivered, in 1871, the annual oration on "Modern Medicine"; he was also a member of the Senate of the University of London. He received several foreign Orders, including that of the Legion of Honour of France, of the Crown of Russia, St. Olaf of Norway, Danebrog of Denmark, and the Rising Sun of Japan.

BY the death of M. Léon Labbé, full of honours and of years, France has lost one more of the Old Guard, the physicians and surgeons who were already in practice when Pasteur and Lister were young. It is just forty years since Labbé's "wonderful case," in 1876, of the successful removal of a fork from the stomach of a young man who had been playing tricks with that implement. The case got into the papers; Mr. Andrew Lang, in a delightful article in the *Daily News*, quoted Horace, "Naturam expellas furcâ," and observed that the surgeon, being unable to expel the fork by nature, had to call in the aid of its brother, the knife. But the point of the case is that it advanced the surgery of the stomach, especially the relief of patients with obstruction of the œsophagus by the introduction of food straight into the stomach through a narrow tube. For half a century Labbé practised and taught surgery in Paris, and his renown was great and well deserved. It was he, also, who in 1914 helped to bring about the law by which the protective treatment against typhoid fever is compulsory in the French Army. At the time of his death he was working hard in Paris for the French Army Medical Service. The honours of his profession came to him: he was president of the Société de Chirurgie in 1882; he was a member of the Académie de Médecine, and Commander of the Legion of Honour. He was a great French gentleman, handsome in face and in soul, and it seems a pity that he did not live to see France set free, and the dragon under her feet.

WE record with regret the death, at Southsea, on March 30, of Dr. J. T. Leon, from cerebro-spinal meningitis, contracted from a military patient under his care. From an obituary notice in the *Lancet* we learn that Dr. Leon, who was fifty years of age, started his scientific career with the intention of being a chemist, and after leaving Clifton went to Germany. Later he entered at Unversity College, London, where he was Tufnell scholar in 1885. Two years afterwards he graduated as B.Sc. Lond., and in 1890 was appointed assistant lecturer on physics and demonstrator of chemistry in St. Mary's Hospital Medical School. After holding those appointments for three years, he commenced his medical studies at St. Mary's, where he had a successful career, graduating as M.B. Lond. in 1896, and D.P.H. Camb. in the following year. After qualifying he was appointed on plague duty in India, where he did useful work in collaboration with Prof. Haffkine. He served throughout the South African War, and upon his return settled in practice at Southsea. On the outbreak of the present war he was mobilised as captain in the Royal Army Medical Corps (T.), and was appointed sanitary specialist officer for Portsmouth. His duties involved the inspection of the sanitation of the various camps in Hampshire, and the carrying out of the bacteriological work in connection with the various epidemics that arose. He worked assiduously at these posts, and there is no doubt that his death was due to his unsparing devotion to duty.

THE announcement of the death of Mr. J. H. Collins, F.G.S., on April 12, at the age of seventy-five, will be received with deep and sincere regret by a wide circle of friends, including nearly every person in Cornwall, where he was such a well-known and

picturesque figure. He was a past president and honorary member of many learned and scientific societies, including the Institution of Mining and Metallurgy, of which he was also one of the founders; the Royal Geological Society of Cornwall; the Royal Cornwall Polytechnic Society; and the Royal Cornwall Institution. He was also an honorary member of the Imperial Mineralogical Society of Petrograd. For his scientific work he received the Henwood medal from the Royal Institution of Cornwall in 1893, and the Bolitho medal from the Royal Geological Society in Cornwall in 1898. He was the author of many very valuable works, all of which are regarded as classics on his special subject, including "Observations on the West of England Mining Regions," "The Hensbarrow Granite District," "Handbook of the Mineralogy of Cornwall and Devon," "Cornish Tin Stones and Tin Capels," "Origin and Development of Ore Deposits of the West of England," translation of M. Léon Moissenet's "Rich Parts of the Lodes of Cornwall," text-books on mineralogy for elementary and advanced students, and many others. He was chief chemist and metallurgist to the Rio Tinto Copper Mining Company for a period of more than twelve years, and latterly was chairman and managing director of the Wheal Kitty and Penhalls United Limited Tin Mines of Cornwall, and a director of the East Pool and Agar Mines, Ltd. For nearly half a century Mr. Collins devoted himself to a close study of the geology, mineralogy, chemistry, and metallurgy of the mines and mineral deposits of Cornwall; and it may be truly said that his knowledge of this special subject was unique. His death has left a gap in Cornwall which cannot easily be filled.

SOME years ago Prof. Richard A. J. Berry, of the University of Melbourne, rendered anthropologists a great service by publishing exact tracings of all the Tasmanian skulls he could find in Australian collections. In conjunction with Dr. A. W. D. Robertson he has now issued (Transactions of the Royal Society of Victora, vol. vi., 1914) an atlas of tracings of ninety crania of Australian aborigines. Each tracing is reproduced in natural size, three views being given of each skull. In a brief preface to this atlas of cranial tracings, we learn that the Commonwealth Government is awakening to the scientific value of the skeletal remains of its native races, and is to take steps to prevent the exportation of osteological material from Australia.

THE Journal of the Buteshire Natural History Society, vol. viii. (1914–15) is largely devoted to local antiquities. Dr. J. N. Marshall and Mr. J. Ritchie describe excavations at the fort and cave at Dunagoil, the peninsula at the southern end of the island of Bute. The cave, which was hollowed out by sea action, was obviously, like the fort, occupied in ancient times. The mammalian bones found included those of the wild cat (*Felis sylvestris*), the fox, wild boar, red and roe deer, the short-horned Celtic ox, and turbary sheep, the two last having been apparently domesticated. The animal remains as a whole would be sufficient to indicate that the cave-men belonged to a period not earlier than that of the predominantly round-headed Neolithic people. The absence of remains of the horse suggests that this animal, so common in Romano-British deposits, had not yet reached Bute, if indeed it had been introduced to Scotland at the time when the Dunagoil cave was inhabited. The most interesting remains of human occupation are bone and horn implements, stone pounders, and the spinning-whorl, while a piece of sheet bronze proves that after the disappearance of the earlier tenants the cave was occupied in the Bronze age. The report, which is well illustrated with plates of the discoveries, is a good example of the excellent work which can be done by a local society, the membership of which includes competent archæologists.

THE annual report of the Public Health Committee of the London County Council for 1914 has just been issued. It contains the reports of the county medical officer (Dr. Hamer) and school medical officer, and details of public health administration, main drainage, and housing of the working classes. The report is illustrated with a number of diagrams of statistical data. One of these shows the seasonal prevalence of body-vermin (bugs, fleas, and lice), and it is of interest that the seasonal prevalence of scarlet fever coincides with that of fleas. Whether this is merely a coincidence or no, further study alone can elucidate. The death-rate is slightly above that for 1913, and scarlet fever, diphtheria, typhoid fever, and erysipelas all show some increase of prevalence compared with preceding years. The marriage-rate attained the comparatively high level of 19·2, but the birth-rate again showed a diminution.

IN the *Psychological Review* (vol. xxiii., No. 2) Mr. J. B. Watson describes a means whereby a wide range of experiments can be performed on the conditioned reflex. The author claims that the method can be immediately applied to the study of many sensory problems, such as sensitivity to temperature and contact, fineness of localisation, differential sensitivity to pitch, etc., in animals, whether wild or domesticated, of any size, and in man also, and that the record is made in complete and permanent form by the animal itself. Students of animals, whether from the physiological or the psychological point of view, will find the article both interesting and suggestive.

THE growing interest in problems of psychology, and in particular in the experimental treatment of such problems, is plainly indicated by the appearance of the first number of the *Journal of Experimental Psychology*, published under the auspices of the *Psychological Review* Company. An interesting article, entitled "A Preliminary Study of Tonal Volume," will appeal to both physicists and physiologists. There has been much divergence of opinion as to whether extensity is really an attribute of tonal sensations or merely a question of association, low tones being associated to large instruments and to gross movements of the throat. As a result of a careful investigation G. J. Rich comes to the conclusion that if we accept independent variability as the criterion of an attribute, there is evidence for the differentiation of pitch and tonal extensity, judgments of tonal volume being made with as great consistency as is usual for attributive judgments.

SIR F. J. JACKSON describes, in the Journal of the East Africa and Uganda Natural History Society (vol v., No. 9), two nests of the African lung-fish (*Protopterus ethiopicus*). They were situated in a patch of coarse grass, were circular in shape, with a diameter of two and a half to three feet, and about eighteen inches in depth. But the most remarkable feature of these nests lay in the outer ring of mud, which was raised about an inch above the water-level and about five inches width. It had the appearance of being the work of a man rather than of a fish. The mud did not seem to have been pushed up from below, but rather to have been deposited from above, and then smoothed down, the surface being smooth and shiny. He suggests that this mud was brought to the surface in the mouths of the builders, and then beaten down by means of the flattened, slimy, eel-like tails.

MUCH attention has been paid in America to prevention of damage by frost to fruit and vegetable crops. The methods are based either on the prevention of low temperatures, or the protection of frosted plants from too rapid warming. The *Geographical Review* for February, 1916 (vol. i., No. 2), contains an illustrated article on the subject. Low temperatures are prevented by small fires, oil-pots (Fig. 1), steam pipes, or even by hot water in irrigation ditches. Apparently no method to utilise electrical energy has yet been devised. To reduce loss of heat by radiation, artificial clouds are caused by fires of wet straw, but lath screens are most effective, though too expensive as a rule. Mixing the air by some mechanical means to prevent ground frost on clear, calm nights would be useful, but no practicable method has been discovered. Rapid warming or "defrosting" is prevented by the same means used to check radiation, and also by spraying the plants with water at about 32° F. just before sunrise. This coats the plant with ice, which must be melted before warming can begin. As a result, warming is said to be gradual. All these, and other methods, are, of course, intimately associated with accurate weather forecasts, since the preventive measures are too elaborate and expensive to be employed unless required.

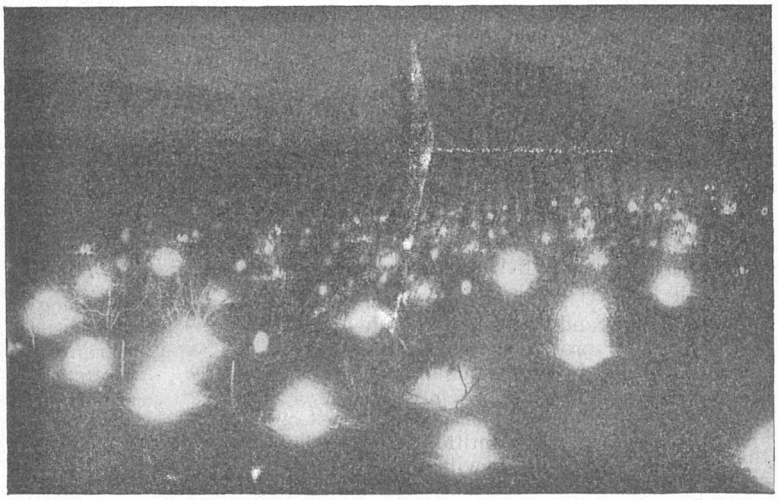

Photo. *F. E. Dean.*

FIG. 1.—Oil pots in operation in an orchard at Grand Junction, Colorado. The oil pots hold seven gallons each and burn crude oil in amounts depending on the heat required.

A SUMMARY of temperature, rainfall, and duration of bright sunshine in the United Kingdom for the first quarter of the current year, comprised in the thirteen weeks from January 2 to April 1, 1916, has been issued by the Meteorological Office. The mean temperature for the period was in excess of the average in all districts, except the south of Ireland, where it was normal; the greatest excess was 1·6° in the east of England. The absolute maximum temperature ranged from 53° in the north of Scotland to 65° in the east of Scotland, and the thermometer failed to touch 60° in several districts, including the south-east and south-west of England. Rainfall was in excess of the average in all districts over Great Britain, except the west of Scotland, and there was a deficiency of rain in Ireland. The greatest excess was 177 per cent. of the average in the east of England, while in the south-east of England the fall was 161 per cent. of the average, and 160 in the Midland counties. In the east of Scotland the rainfall was 141 per cent. of the average, while in the west of Scotland the fall was only 88 per cent. In the north and south of Ireland the fall was respectively 93 and 92 per cent. of the average. The rain-days were everywhere in excess of the normal, the number in the period ranging from 72 in the south of Ireland and 71 in the north of Scotland to 56 in the north-east of England and in the Midland counties. The duration of bright sunshine was generally deficient. The exceptional warmth of January and the heavy rains of February and March would considerably influence the quarter's results.

MR. P. W. STUART-MENTEATH has forwarded to us a group of pamphlets on the results of his long-continued investigations into the geological structure of the Pyrenees. They have appeared in the *Biarritz Association*, and are entitled "Sur les Gisements Métallifères des Pyrénées Occidentales," because the interpretation of that structure greatly depends on the geological age of certain metalliferous (chiefly iron) deposits, in regard to which he differs widely from some members of the French Geological Survey. The question is too long and intricate to be dealt with in a short note, so that it must suffice to say that the map in one of the pamphlets, which represents his own views and recalls certain parts of the Alps, has a very reasonable aspect, and that he is opposed to a school of geologists in France who make greater demands on flat-folding and overthrusting than some who have studied that chain are willing to admit. His criticisms chiefly relate to the Survey map of the Mauléon Pyrenees, which is contradictory to his own observations; and these, as experience has taught him, are likely to be ignored, and if possible suppressed. He taxes its authors with misplacing sedimentary and intrusive rocks, confusing Cretaceous and Upper Palæozoic deposits, transforming typical Cenomanian and Trias into Silurian and Carboniferous, and transferring great slices of sedimentary strata from the southern to the northern side of the chain. If the charges which he brings against MM. Bertrand, Termier, and Carez be accepted, we must suppose that French geology is suffering from the incubus of official infallibility not less seriously than did British geology some five-and-thirty years ago.

ALTHOUGH in the last seven years there have been more than a dozen determinations of the constant of complete radiation, the results obtained have differed so widely that it has not been possible to fix on a definite value. Some of the differences may be accounted for by the radiators or the absorbing surfaces of the measuring instruments not being perfectly black, or by the neglect of the absorption of the radiation by the water vapour present in the air. Or it may be due to the form of measuring instrument adopted, and in this connection it is worth noting that when the radiation has been measured by a thermometric method, the result has in general been high, while the pyrheliometer has given mean results in fair accord with each other. In Scientific Paper No. 262 of the Bureau of Standards of Washington Mr. W. W. Coblentz reviews the work which has been done by his predecessors and recently by himself

on the subject and comes to the conclusion that the most probable value of the constant is $5{\cdot}75\times10^{-12}$ watt. cm.$^{-1}$ degree^{-4}.

THE composition of the exhaust from liquid-fuel engines has been studied by Mr. R. W. Fenning, who presented a paper on the subject to the Institution of Mechanical Engineers on March 17. Various fuels were employed, the considerations affecting their choice being volatility, purity, and general suitability for use as motor spirit; hexane and benzene were taken as standard, high-grade petrol and benzol as commercial fuels. Mixtures with air were exploded in a small glass vessel, and a complete chemical analysis was made of the products. Exhaust samples were also taken from an engine fitted with Dr. Watson's apparatus for measuring air and fuel, and these samples were analysed. In each case a set of curves was plotted, taking as abscissæ ratios of the fuel to air by weight, and as ordinates percentages of each of the products of combustion in turn. Such a set of curves is termed an exhaust-gas chart. The author concludes that with volatile fuels there is little difference in the composition of the products of combustion from air-fuel mixtures in a small explosion vessel or in an engine cylinder in spite of the conditions being so dissimilar. Another conclusion is that a very small quantity, if any, of unsaturated or saturated hydrocarbons is present in engine-exhaust gases; this statement is, of course, based upon the results obtained in gas analysis by the method adopted and described.

AN important paper by Dr. C. H. Desch, on "The Decay of Metals," is included in a recent issue of the Transactions of the Institution of Engineers and Shipbuilders in Scotland (vol. lix., part 5). Three chief types of decay are considered. The first is that due to allotropic change, of which the "tin pest," studied by Prof. Cohen, of Utrecht, is the most notable example; similar disintegration may, however, occur in certain light aluminium alloys, which are liable to fall to powder as a result of internal molecular change, though fortunately this does not occur with any of the alloys in common use. Disintegration may also occur as a result of internal strain set up by hard working. Thus drawn rods are in a state of severe tension in the outer layers, and in compression in the inner layers, whilst in rolled or hammered rod this distribution of stresses is reversed. The fracture of the strained metal may be accelerated by corroding agents, which in some cases cause it to crack with almost explosive violence, as when very hard-drawn rods of brass or bronze are touched with a solution of a mercury salt or of ferric chloride. Finally, metals may decay as a result of actual corrosion, as in the "graphitisation" of iron pipes, from which all the ferrite is removed, leaving a soft residue of cementite, phosphide, and graphite. All these different types of decay are illustrated by photographs, the excellence of which has become almost a commonplace feature in the work of the author.

MR. WM. SHACKLETON, assistant inspector of scientific supplies at the India Store depôt, writes to direct attention to the numerals designed by his predecessor, Col. A. Strange, F.R.S., in the early 'seventies. These are still used on surveying instruments of to-day. Mr. A. P. Trotter is a nephew of Col. Strange. He illustrated these numerals in the Journal of the Institution of Electrical Engineers for February 1, gave details of their dimensions, and used them as a basis for his attempt to design an improved set (see NATURE, February 24, p. 714, and April 6, p. 121).

OUR ASTRONOMICAL COLUMN.

COMET 1916*a* (NEUJMIN).—The following elliptic orbit has been derived by collaborators in the Berkeley Astronomical Department (Lick Observatory Bulletin, No. 280), from observations on February 29 (Yerkes), March 8 (Bamberg), and March 7 (Lick):—

T = March 11·2195 G.M.T.		P = 5·186 years.	$\mu = 684{\cdot}14''$
$\omega = 193^\circ\ 44{\cdot}1'$.		$e = 0{\cdot}55465$.	
$\Omega = 327^\circ\ 38{\cdot}8'$.		(whence $\phi = 33^\circ\ 41'\ 11{\cdot}8''$.	
$i = 10^\circ\ 29{\cdot}6'$.		$\log a = 0{\cdot}47658$).	

The resulting ephemeris diverges in R.A. from that calculated at Copenhagen; thus interpolation for April 20 gives α 10h. 3m. 58s., and $\delta - 7^\circ\ 38{\cdot}0'$; the Copenhagen position being α 10h. 2m. 41s., and $\delta - 7^\circ\ 34{\cdot}0'$.

The comet was observed at the Hill Observatory, Sidmouth, on April 8. It was then very diffuse and faint, in approx. position at 9h. 27·1m. G.M.T., α 9h. 39m. 51s., $\delta - 3^\circ\ 54{\cdot}9'$, very nearly midway in Right Ascension between the positions given by the two ephemerides.

SOLAR RADIATION.—Mr. R. S. Whipple's paper on instruments for the measurement of solar radiation, read before the Optical Society of London on March 11, contains an account of all the most important forms of instrument, from the Campbell sunshine recorder and the black bulb *in vacuo*, to the registering standard water flow pyrheliometer of the Smithsonian Institution. Of these instruments the Campbell sunshine recorder still holds its own as one of the most accurate means of measuring the duration of sunshine, while the black bulb *in vacuo*, the readings of which have been recorded so many million times by patient observers, is now thoroughly discredited. At the International Meteorological Congress in 1905 the Ångström pyrheliometer was adopted as the standard instrument for the measurement of the intensity of solar radiation. In this instrument one of two similar metal strips is heated by the radiation to be measured, the other by an electric current sent through it. Equality of heating is secured by two thermo-junctions behind the strips, the necessary heating current is read, and the rate of supply of energy calculated. According to the most trustworthy measurements made under conditions more favourable to accurate observation than our climate permits, the earth receives from the sun, on the average, 0·032 calories per square centimetre per second.

PROPER MOTION OF THE ORION NEBULA.—M. J. Comas Solà has obtained direct evidence that the annual proper motion of the great nebula is about $0{\cdot}025''$ by stereoscopic comparison of photographs. The near by small nebula, A.G.C. 1977, shows equal motion, but in the opposite direction, and it is considered to be in orbital relation with the first.

THE SYSTEM OF λ TAURI.—Prof. F. Schlesinger has found that λ Tauri most probably involves three main bodies, only one being bright enough to yield a spectrum (Publications, Allegheny Observatory, iii., 20). Partial eclipses at intervals of four days result from the revolution of a less massive satellite, whence also arises the chief oscillation of the spectrum lines, but a second more remote and smaller body betrays its existence and period of 34·6 days in a superposed secondary oscillation revealed by the residuals. The respective masses are largely conjectural; on certain assumptions they would be 2·5, 1·0, and 0·4 solar, and the distances from the centroid of the first two 3·2, 8·0, and 50·0 millions of kilometres. The great range of velocity (56·18 km.) found by Prof. Schlesinger, asso-

ciated as it is with a spectrum of early, though somewhat peculiar, type, has an important significance in relation to some of the suggested explanations of the tardy motions of isolated helium stars.

THE INSTITUTION OF NAVAL ARCHITECTS.

THE spring meetings of the Institution of Naval Architects were held on April 12 and 13, at the Royal Society of Arts. The Marquis of Bristol's term of office as president has now expired, and he has been succeeded by the Earl of Durham. The institution scholarship has been awarded to Mr. T. S. D. Collins; a donation of 100*l.* has been made to the scholarship fund by the Earl of Durham; the annual gold medal has been awarded to Mr. A. W. Johns, and the premium to Mr. J. L. Kent, for papers read before the institution. The following members of the institution have been appointed to the Board of Trade Committee to consider the position of shipping and shipbuilding industries after the war:—Sir A. A. Booth (chairman), Sir Archibald Denny, Mr. W. S. Abell, and Mr. James Readhead. A presentation was made to the retiring president.

In the course of the Earl of Durham's address, he said that one paramount duty was before the whole nation—to prosecute the war until a satisfactory end was reached. Our naval architects had no better pride than to turn out everything destined for the Navy of the best possible quality. When the end of the war came he felt sure that the institution would be able to claim having done its share in the work.

Sir Philip Watts read a paper on the load lines of merchant ships, and the work of the Load Line Committee (1915). This paper consists largely of a historical summary, starting with the earliest recorded regulation, which appeared in Lloyd's Register book in 1774. The remainder of the paper gives the gist of the report of the Load Line Committee, presented in a form convenient for the purposes of the institution. Mr. W. S. Abell followed with a paper on some questions in connection with the work of the Load Line Committee. The question principally discussed is the formulation of a suitable standard of structural strength which might be adopted internationally for the necessary tests which it is desirable to lay down in order that the freeboard assigned shall not be so small as to bring undue strains upon the structure of a vessel. The rules of the registration societies have been developed from experience, and should form the basis of any analysis having for its object a general average of experience with ship structures at sea. The method adopted was to analyse the rules of the principal societies in terms of I/y, and the principal dimensions of the vessel with the view of obtaining a standard of longitudinal strength which would express rationally the minimum requirements found necessary from successful sea experience. In this way formulæ were found for the standard of longitudinal strength, the thickness of side plating, frame spacing, and the strength of hold frames. This paper is a valuable summary of some interesting work on the strength of ship structures.

Dr. C. H. Lees read a paper on the laws of skin friction of a fluid in stream line and in turbulent motion along a solid of great length. In this paper Dr. Lees shows how to reduce the problem of a very long body of rectangular or elliptic section towed along a wide tube filled with liquid, to the simpler problem of a long circular cylinder towed along the same wide tube, so long as the liquid moving past the body is in stream-line motion. Comparison of results calculated for the equivalent cylinder and Froude's boards shows very fair agreement for the last 34 ft. of the boards. The agreement is sufficiently close to show that there is in all probability an intimate connection between the frictional resistance of the after portion of a long towed body and that of water flowing through a pipe. It seems desirable that experiments should be made with the view of determining to what extent the propositions with regard to bodies of equivalent resistance in stream-line motion may be carried over to eddying motion, and, if it should prove they cannot be, to determine the corresponding propositions for eddying motion.

Mr. G. S. Baker contributed a paper on the skin friction resistance of ships, and our useful knowledge of the subject. The data for the friction of rough surfaces have been increased very considerably in the last few years. Most of the data are derived from model experiments, but in some cases authentic data for ships are available. One model of fine form, 16 ft. in length, tested in the National Tank, showed that plate edges increased the frictional resistance 3·7 per cent. The plates on the model represented 4-ft. strakes of $\frac{3}{4}$-in. plating on a 400-ft. ship. A plate, 20 ft. by 2 ft., tested in the Washington tank after immersion in Chesapeake Bay for two months (July and August, 1914) showed an increase in resistance over that of a smooth surface of about 50 per cent. The fouling and resistance went on increasing up to the month of December, when the resistance stood at about 220 per cent. increase over that for a smooth surface, and remained at that figure for some months. This suggests that a good time for cleaning and painting the bottoms of coasting ships, working at about this latitude, is October and November, as there is little growth in cold water for the next few months. Presumably there would be a period about May and June when the temperature had reached a point favourable for growth, when a new coat of paint would prevent the adhesion of growth to the surface.

In a paper on the subdivision of merchant vessels and the Reports of the Bulkhead Committee, 1912–15, Sir Archibald Denny suggests that, after the war is over, an interesting paper might be written dealing with the mass of information which will no doubt be available as to the behaviour of vessels damaged either sufficiently or insufficiently to sink them. It is interesting to know that many vessels have survived torpedo and mine attack, even when the damage was of a very extensive character. Thus the *Nigretia* struck a mine abaft the fore peak, and had a hole 40 ft. by 16 ft. blown in her, but she was saved by No. 2 bulkhead. The Germans also have not always realised the difficulty of sinking an oil-carrier, especially if she is running light—*vide* the *Artemis*. The tests made by the Bulkhead Committee on large tank bulkheads are described in a paper by Mr. J. Foster King. Drawings showing the deflection records and photographs of the bulkheads are included. In all, fourteen papers were read and discussed.

DANISH LABOUR ON BRITISH FARMS.

THE Board of Agriculture proposes to relieve the present shortage of labour on the farm by arranging for the introduction of agricultural workers from Denmark. In this connection attention may be directed to an exceptionally interesting article by Mr. J. Robertson Scott in the January number of the *Quarterly Review*.

The wonderful development of rural life in Denmark is largely due to the absence of coal and iron. Having practically no manufacturing industries, the Danes

have put their best brains and energies into the cause of agriculture, with the result that their system of rural economics is a model to the world. The high standard of agricultural education is chiefly responsible for this success; it is significant that 20,000 Danish farmers possess covered manure sheds, while 90,000 have water-tight liquid manure tanks. But in comparing this state of affairs with conditions on our farms at home, it must always be remembered that our system of land tenure does not favour similar development here. It is not only ignorance that still causes so much of the fertilising value of farmyard manure to be lost by careless storage. The Danish farmer, owning his holding, is able to borrow from his credit society the capital necessary for these improvements; the English tenant farmer is not in the same position. Many landlords cannot provide these aids to successful farming, even if they realise that it is to their ultimate advantage to do so.

It is, however, to the rural high school that we must look as the real source of Denmark's present agricultural prosperity. It may surprise many to learn that no merely utilitarian outlook dominates these schools. On the contrary, they endeavour to show the power of history, poetry, and science, and of a higher level of life and thought to glorify ordinary workaday existence. How will a man trained in an atmosphere of this kind fill the place of a typical agricultural labourer on our farms? If Danish workers are introduced in any numbers into English rural life the results cannot fail to be of great interest.

THE CULTIVATION OF SPONGES.

AN industry which promises a return of 3000 per cent. per annum on a very moderate capital expenditure is an attractive proposition. In the last issue of the *West Indian Bulletin* Mr. W. R. Dunlop describes the successful rearing of sponges from cuttings in the Caicos Islands, near Jamaica, and also the results of some earlier experiments in Florida. The sponges occurring naturally in West Indian waters have little commercial value, so that the material for planting must be imported. Although sponges are to a remarkable extent creatures of environment, and tend when transplanted to approach the native types in quality, there is evidence that this may not occur in selected localities in the Lesser Antilles. As the cuttings will only grow when attached to an anchorage, it is necessary to provide them with suitable means of support when planting out. Cement discs are used in Florida, to which the sponges are held by metal clips, but it has been found in the Caicos Islands that slabs of coral are quite as effective as the discs and naturally much cheaper. On soft or sandy bottoms a spindle is set in the disc to hold the cutting, otherwise the sinking of the disc tends to bury the sponge and kill it.

The crop is ripe for harvesting in from one to four years, according to the variety grown. To plant, harvest, and market one acre of sheep's-wool sponges costs about 4*l*. This is a large and valuable variety, taking four years to mature, and yielding 116*l*. per acre in the New York market. Assuming that one acre is planted each year, then, after four years, an annual expenditure of 4*l*. will yield an annual profit of 112*l*., if four acres only are under cultivation. No charge for management is included in this estimate. The growers in the Caicos find that the small reef sponges, in spite of their lower market value, give an even better return on capital than the wool sponges, because they mature in twelve or fourteen months. It will be surprising if this industry, apparently so profitable, needs much official encouragement.

NATIONAL ASPECTS OF CHEMISTRY.[1]

EXACTLY seventy-five years ago from March 30, 1916, the Chemical Society met for the first time at the Royal Society of Arts after a preliminary meeting on February 23, 1841, at which it was decided "that it is expedient that a Chemical Society be formed." Though the society has continued to hold its anniversary meetings on or about March 30, ever since then, under various conditions, no meeting except that in 1915 has ever been held in circumstances at all approaching those now prevailing throughout the entire globe. The Crimean and Boer Wars did not awaken in the nation any appreciation of the increasingly important *rôle* played by chemical science in warfare. On the other hand, the enormous possibilities for the destruction of human life afforded by the application of scientific methods to warfare had inclined people to the belief that such a war as the present, with its ruthless disregard of life, could never occur. Short of demonstration, chemists would never have believed that their science could have been prostituted as it has been by the enemy.

Many thoughts arise in our minds on such an occasion as the seventy-fifth anniversary of our society, leading us to reflect on the state of chemical science before 1841, on the aims and purposes for which it was deemed expedient to form such a society, and to examine the measure of success that has been achieved by the society in fulfilling the objects as laid down in the charter.

Reference was made to various letters received from the founders of the society, and to one in particular from Henry Fox Talbot, the well-known pioneer in photography, expressing the view that the science of chemistry alone was not sufficient to engage the attention of a society, and suggesting that electricity should be added. How erroneous was this view is shown by the fact that within a month or so of its formation the Pharmaceutical Society was founded, and of later years, amongst other societies which have sprung from the parent society, may be mentioned the Society of Public Analysts, the Institute of Chemistry, and the Society of Chemical Industry, each of which has its important functions to perform.

Looking back to the time of the "father of chemistry and brother of the Earl of Cork," who in his introduction to the "Sceptical Chymist" stated "that of late chymistry begins, as indeed it deserves, to be cultivated by learned men, who before despised it; and to be pretended to by many, who never cultivated it, that they may not be thought to be ignorant of it," one may indeed wonder, on perusing our Parliamentary and legal reports, how our legislators should be classed in accordance with this statement, and to doubt whether the attitude of so-called learned men towards chemistry had done more than "begin" to change during the last two centuries. The beginnings of this change and the initiation of the experimental method into true science by Robert Boyle and his contemporaries followed closely upon the Civil War. For a hundred years or so onwards from the time of Boyle, the gradual substitution of careful experimental work in place of speculation on the reasons for chemical and physical changes added greatly to our knowledge. The rise and development of the phlogistic theory and its final overthrow by Lavoisier illustrate this phase in the growth of our science. The vast strides made in the progress of chemistry date back to the time when the use of the chemical balance was insisted on by Black; by its use chemistry became an exact science. Black's modesty and his devotion to scientific inves-

[1] Abstract of the Presidential Address, entitled "Our Seventy-fifth Anniversary," delivered before the Chemical Society on April 6, by Dr. Alexander Scott, F.R.S.

tigation for its own sake often led to his claim to be considered as the founder of modern chemistry being overlooked.

The importance of chemistry to national existence was recognised in France as early as 1815, as is witnessed by the origin of the "Le Blanc Soda" process and the beet sugar industry in France. In our own country the electrolytic work of Davy and the discovery of benzene and of liquid chlorine by Faraday have formed the starting points of many of the manufactures of munitions and weapons of war now being employed, though more especially by the enemy.

Just as the Royal Society grew out of societies of a more informal nature, so the Chemical Society had as forerunners the Tepidarian Society, the Animal Chemical Society, and also a Chemical Society or Club to establish which an attempt was made in 1806.

From the very foundation of the society stress has been laid time and again, and by president after president, that it is upon the amount of research work carried out by its fellows that the reputation and true value of the society must depend. At the first anniversary meeting the council reported that it was "fully sensible that the utility of the society and its reputation in the scientific world will mainly depend on its publications." A curve was thrown on the screen showing the steady increase year by year in the number of original communications contributed to the Transactions, commencing at 42 (occupying 254 pp.) in 1841 and 1842, and reaching 272 (occupying 2909 pp.) in 1914. In 1905 the first volume of the annual reports on the progress of chemistry, initiated by Sir William Tilden, was published.

The president then dealt briefly with the progress made year by year by the society, referring more particularly to the jubilee of the society in 1891, and to the jubilee (in 1906) of the discovery of mauve. In 1876 a proposal to establish a research fund was revived, when Dr. G. D. Longstaff promised to give a sum of 1000*l.* if an equal amount were subscribed by chemists. With a like sum from the Goldsmiths' Company, together with donations from the Merchant Taylors' Company, the Mercers' Company, and the Clothworkers' Company, the research fund was placed on a sure foundation.

Reference was made to the importance of stimulating and encouraging research if we, as a nation, are to hold our own in commerce and manufacture. That it is the duty of everyone to do his utmost to wrest from nature her secrets is tacitly agreed to by all, but, unfortunately, there the matter rests. The apathy of the public to the vital importance of research is due in great measure to the fact that the so-called well-educated classes have no conception of what research means. The classical scholar pure and simple adds but little to the sum of human knowledge. He examines the knowledge accumulated in past ages, extracts what is buried there, much as a ploughman on the battlefield of Waterloo looks for a bullet fired a hundred years ago. He wonders by whom the bullet was fired, whom it hit, and other such matters, which, however interesting they may be, are of little use to anyone. The classic may retort by demanding of what use are many of our chemical researches? Let us look, therefore, at what research has done.

Research may be divided into two categories: (1) the mere addition of fresh knowledge to that already recorded: of fresh mastery over the powers of nature and of new ways of utilising energy; and (2) the definite quest for the solution of a particular problem, it may be the manufacture of something occurring in nature or of something which shall have definite properties. The experiments of Cavendish on the composition of the atmosphere when he converted nitrogen and oxygen into nitric acid are typical of the first class of research. From this discovery an industry of vast importance to the world, the utilisation of atmospheric nitrogen, has sprung up in Norway, America, and Switzerland. Moissan's researches into the reactions at temperatures producible by means of the electric arc led to the production of many new compounds, including calcium carbide. These two industries have been established as the result of experiments made solely to increase our knowledge. Who could have foreseen what the discovery by Faraday of benzene in oil-gas would lead to at no distant date?

As examples of the second type of research may be mentioned the researches which led to the synthesis on a manufacturing scale of alizarin and of indigo, and to those which led Ehrlich to the discovery of salvarsan.

Broadly, there are two types of chemists who enlarge our knowledge: the one who feels that he can best fulfil his life's purpose by devoting himself to the discovery of new laws and new substances for the simple purpose of increasing the store of general knowledge so that those who follow after may reap the benefit of his labours. For such a man the reward is too often only the joy of having succeeded in his aim, well knowing that the money prizes attached to the application of his discoveries to industry will not be his. The other type is the man of practical bent who is always striving to apply the knowledge of the laws of nature and of the properties of substances to the solution of definite problems which confront the chemical manufacturer, the engineer, and others. Both types of men must be trained in the most thorough manner possible in the universities, and be taught how to tackle both theoretical and practical problems in a scientific manner.

The manufacturer is prone to expect his research chemist to indicate almost immediately the value of his presence in the works by a visible increase being shown in the profits. It is by no means a rare thing for a chemist employed at a miserable salary to be consulted in the same way as a specialist who is called in to see the patient on his death-bed. Had the aid of the chemist been sought earlier he, like the specialist, might have been successful in achieving the desired object. If the chemical manufacturers are not only to hold their own, but are to save themselves from extinction, there is only one remedy: they must seek the services of the man with a broad and sound foundation of the facts and theories of the day, and with a thorough training in the methods of advancing knowledge. Merely to maintain the dead-level of a fair measure of success is an existence which can only satisfy a decadent race, and this war has shown the British race to be as full of energy, bravery, and chivalry as of old.

The nation is now learning day by day what neglect of science has meant to it, and our legislators are having the importance of science forced upon them. Perhaps no branch of scientific knowledge has been more appreciated for the time being than chemistry, though it has required hundreds of thousands of tons of T.N.T., lyddite, and dynamite to shade the foundations of their ignorance.

The newspapers and scientific journals have laid bare the defects of our education, more especially with reference to our scientific education. It is obvious that if the manufacturer is to employ properly trained chemists, he must be provided with an adequate supply not only of men trained in what are known phenomena, who may be mere walking encyclopædias, but of men who are trained to attack problems.

There are, however, many points which our newspaper correspondents overlook when casting blame on the various educational authorities for their shortcomings. Much difficulty was experienced by head-

masters in obtaining men who could teach and keep order in a class. Often the man who taught science in school did so as junior mathematical master because his other teaching duties were lighter than those of his colleagues; but his knowledge of the subject might be but little deeper than that of the scholars he was instructing.

Where schools have been fortunate enough to secure properly trained science masters, the masters have usually to prove their value to the school, not by sound, all-round teaching, but by devoting much time to coaching-up the brilliant boys to win scholarships. Owing to the absurd nature of many of the questions set at the open scholarship examinations, candidates are forced to read and "get-up" quite specialised branches of work of far too advanced a nature, instead of devoting themselves to acquiring a sound knowledge of the principles and experimental data and their relations to the fundamental principles of science. Again, the successful scholar, say, in chemistry, is usually too proud of his position to go to a course of lectures on general chemistry by the professor, but prefers to attend special courses on advanced subjects, and thus become a specialist long before he should, suitable, perhaps, to hold a fellowship of his college, but almost as unfitted as his fellow-classic for active and useful life in an industrial centre and for facing industrial problems.

The brilliant youth who goes to Oxford or Cambridge, and whose ambition it is to lead the life of a student, is taught to regard the fellowship of his college as the greatest prize at which he can aim. Although the college authorities may state that the chances of gaining a fellowship are open equally to a science and to a classical student, this is not the case, for the simple reason that the electors to fellowships are, in almost all colleges, mainly classical men, who, however fair-minded they may be, are unable to estimate the value of that which they do not understand. Again, in some cases, all the fellowships which a college may devote to natural science are given to one branch.

What are the prospects of a brilliant schoolboy who takes up chemistry as his subject, and, after gaining a scholarship, obtains the highest possible places in the honours examination? If he be elected to a fellowship and decide to remain and take his part in the college life, his income as a fellow can only be regarded as a mere pittance if he is devoting himself to real research work. He may do fairly well at the Bar now that scientific opinion is more frequently sought in patent cases than it was; but no prize equal to the bishopric offered to members of the clerical profession can be his. There is no chance for him to hold any high Government office, for all the Civil Service examinations, whether at home or abroad, are heavily weighted in favour of the classical and mathematical candidate. Everything of a nature to test a man's ability to tackle an unknown problem, however simple its nature, is carefully excluded by cautiously worded syllabuses which detail the range of the facts and the nature of the tests which may be applied.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

WE learn from the issue of *Science* for March 17 that in the will of the late Mr. R. R. Rhodes, of Cleveland, Western Reserve University, through its medical school and affiliated institutions, is a beneficiary to the amount of about 100,000*l.*; and that the will of Marie Antoinette Fisk, of Pasadena, Cal., gives 10,000*l.* to Princeton University.

MR. ARTHUR DU CROS, M.P. for Hastings, has generously promised a gift of 7000*l.* to the Extension Fund of the London (Royal Free Hospital) School of Medicine for Women, thus completing the 30,000*l.* for which appeal was made. The appeal was first put forward in December, 1914, so that the sum has been subscribed in sixteen months. There have been more than twelve hundred subscribers, which is satisfactory as showing wide sympathy with the work of medical women. Next to Mr. Du Cros's generous gift, the largest subscription is 3000*l.* from Mrs. Garrett Anderson. The extension of the school is approaching completion, and will be opened in October next. It is indispensable to the increasing demands made upon the accommodation of the school, as another large entry of students is expected next session.

THE annual report on the work of University College, London, which has now been published, deals with the period February, 1915–February, 1916, and includes financial statements for the session 1914–15. The total number of students who registered during the session 1914–15 was 1416, being a decrease of 790 compared with the preceding session. During the session 335 men students withdrew to join H.M. Forces, and forty-three other students to undertake some other recognised form of national service connected with the war. The total fees available for 1914–15 amounted to 18,936*l.*, a decrease of 9775*l.* on the prevous session. There has been a further decrease, both in the number of students and in fees received for the current session. The financial result in the course of two sessions is that the fee revenue has declined by some 24,000*l.* The position has been relieved by Treasury grants of 10,500*l.* for the sessions 1914–15 and, 1915–16, and economies to the extent of about 9000*l.* will reduce the probable deficit at the end of the current session to 3500*l.* A very gratifying number of war honours obtained by members of the college are chronicled in the report. There are now sixty members of the academic and administrative staffs absent on war service.

THE appointment of a Royal Commission on University Education in Wales is announced. The terms of reference of the Commission are as follows:—To inquire into the organisation and work of the University of Wales and its three constituent colleges, and into the relations of the University to those colleges and to other institutions in Wales providing education of a post-secondary nature, and to consider in what respects the present organisation of university education in Wales can be improved and what changes, if any, are desirable in the constitution, functions, and powers of the University and its three colleges. The following are the names of the persons appointed to serve on the Commission:—Lord Haldane (chairman); Prof. W. H. Bragg, Quain professor of physics, University of London; the Hon. W. N. Bruce, a principal assistant-secretary under the Board of Education; Sir Owen M. Edwards, chief inspector, Welsh Department, Board of Education; Dr. W. H. Hadow, principal of Armstrong College, Newcastle; Mr. A. D. Hall, a Commissioner under the Development Act; Sir Henry Jones, professor of moral philosophy, University of Glasgow; Sir William Osler, Bart., regius professor of medicine, University of Oxford; Miss Emily Penrose, principal of Somerville College, Oxford. The secretary to the Commission is Mr. A. H. Kidd, of the Board of Education, to whom all communications should be addressed.

THE earnest appeal on behalf of the children which appeared in the *Times* of April 17 over the signatures of some of the most distinguished women of the

country demands the serious attention of the Government and the warm support of every true friend of the nation. In the stress of war it would seem that every reactionary influence finds its opportunity, with the result that the strenuous ameliorative efforts of past generations are to be brought to naught, and the fight on behalf of children must be re-fought once more. It is, however, satisfactory to find that some education authorities take a firm stand against the insistent demands of certain agricultural and industrial interests that children shall be released from school at an untimely age to labour in the fields and factories, and it is all-important that enlightened public opinion should support their action. Yet it is greatly to be deplored, having regard to the actual conditions of working-class life in industrial centres, that certain education authorities should, for reasons of so-called economy, seek to close the schools to children under five and to call upon the Government to raise the compulsory school age to six in order that children below that age shall likewise be excluded, with the result that the school life would be limited in certain areas to five years instead of nine. But perhaps the most unworthy demand is that of the managers of textile works in Lancashire, that the children in textile areas shall be compelled, during the war, to enter the factories. As the signatories well indicate, we owe it in reverence for the dead that we refuse no sacrifice in order to raise up a virile generation to justify their noble devotion.

SOCIETIES AND ACADEMIES.

LONDON.

Mineralogical Society, March 21.—W. Barlow, president, in the chair.—Dr. J. W. **Evans**: A new microscope accessory for use in the determination of the refractive indices of minerals. The accessory—a diaphragm with narrow slit adjustable in width—when placed in the primary focus of the objective or any point conjugate with it, serves several useful purposes. If placed parallel to the boundary between the two substances the refractive indices of which are to be compared by the Becke method, it gives better results than an iris diaphragm. In the case of doubly-refractive sections or grains in which an axis of optical symmetry lies at right angles to the microscope axis, the slit is placed parallel to the former axis, so that the paths of all the rays of light traversing it lie in a plane of optical symmetry and one direction of vibration is always parallel to the axis of optical symmetry, and a nicol is inserted so that the direction of vibration of the rays traversing it is parallel to the same axis; then the refractive indices of light vibrating parallel to that axis of optical symmetry may be investigated by the usual methods without the confusion caused by the bifocal images described by Sorby.—L. J. **Spencer**: A butterfly twin of gypsum. In a well-developed twin-crystal, 6 in. across, from Girgenti, Sicily, in which the twin-plane is $d(101)$, the two individuals are situated on the same side of the twin-plane instead of on opposite sides as in the usual type.—Dr. W. R. **Jones**: The alteration of tourmaline. In a moist, tropical climate minerals which are ordinarily regarded as stable break down to an extraordinary degree. At Gunong Bakau, Federated Malay States, tourmaline is found more or less completely altered to a mica (probably phlogopite) and limonite, the degree of alteration decreasing with increasing depth from the surface, suggesting that the change was caused by the percolation of water from above. The freshness of tourmaline grains in sands is very probably due to the removal of the altered products by chemical and mechanical means.

Zoological Society, March 21.—Dr. S. F. Harmer, vice-president, in the chair.—Dr. T. **Goodey**: Observations on the cytology of Flagellates and Amœbæ obtained from old stored soil. This paper deals with the cytology and nuclear changes during division of three species of Flagellates and two species of Amœbæ obtained from soil stored in bottles at the Rothamsted Laboratory for practically fifty years. One of the Flagellates and the two Amœbæ are new to science.

Geological Society, March 22.—Dr. A. Harker, president, in the chair.—Prof. S. J. **Shand**: The pseudo-tachylyte of Parijs (Orange Free State) and its relation to "trap-shotten gneiss" and "flinty crush-rock." The rocks described as "pseudo-tachylyte" occur in irregular veins in the granite-gneiss of Parijs (O.F.S.). The author first regarded them as igneous intrusions; he now compares and contrasts these rocks with the "trap-shotten gneiss" of India and with "flinty crush-rocks" from Scotland, Argentina, and Namaqualand. The veins are irregular in form, dip, and strike; they freely branch and anastomose, and not uncommonly terminate blindly. The material consists of a dense black base, holding fragments of granite; these are sometimes so numerous that the base is reduced to the *rôle* of a mere cement between the rounded boulders. Microscopically, the rocks fall into three types, one of which is opaque and almost without individualised grains or crystals, while the others represent different stages of crystallisation of the first type. The production of the veins involved a temperature sufficient to melt the felspar of the granite, and there has been recrystallisation of felspar in the form of spherulites and microlites, and also of prisms of hornblende. In this evidence of high temperature, and in the absence of shearing phenomena in the granite, the pseudo-tachylyte of Parijs differs from all known crush-rocks and has affinities with pitchstones and tachylytes. Among the crush-rocks of Scotland, the author recognises a passage from the mylonitic type to a type in which fusion has been realised; the latter material is similar to the first of the Parijs types. A chemical analysis of the pseudo-tachylyte shows that the composition is that of a granodiorite, and is such as might correspond to an average of the variable dark gneiss in which the veins occur. It is suggested that a "melt" of granite, produced by mechanically-developed heat arising from the sudden rupture of the granite, would differ from a normal magma of granitic composition, and it is thought that the veins represent the solid equivalents of such a melt.

Physical Society, March 24.—Mr. F. E. Smith, vice-president, in the chair.—Mrs. C. H. **Griffiths**: A new method of determining ionic velocities. In the experiments described the kathode, which consists of a horizontal copper disc perforated with two holes, is mounted in a cylindrical glass tube open at the lower end. The whole is suspended from the beam of a balance, and is immersed in a vessel of copper sulphate. The anode is a copper spiral fixed in the electrolyte some distance below the mouth of the kathode vessel. From the rate of change of weight of the suspended system during the passage of a current the ionic velocities can be determined.—Dr. S. W. J. **Smith**: Note on an explanation of the migration of the ions. The object of this note is to show how a familiar diagram, appearing in many text-books, can be improved in a way which makes it easier to appreciate what happens at the electrodes in the simpler examples of Hittorf's method of determining the migration constant. An attempt is made to give precision to an idea which is sometimes vaguely expressed and frequently ignored.—Dr. S. W. J. **Smith**: A method of exhibiting the velocity of iodine ions in solution. Dilute solutions of potassium iodide and

potassium chloride of equimolecular concentration have almost the same electric conductivity. They are, therefore, of interest in connection with the direct measurement of ionic velocities. The paper describes a simple method of observing their common boundary. It is only necessary to add a little mercuric chloride to the potassium chloride solution. An extremely thin layer of mercuric iodide then forms where the two solutions meet. The method is particularly convenient for lecture purposes, and an approximate value of the ionic velocity can be obtained in a few minutes. The paper gives examples of the use of the method. The current is first passed in the direction which causes the iodine ions to travel towards the chloride. The chlorine liberated at the anode in this case supplies a means of re-determining the velocity of the ions when, the current being reversed, they move in the opposite direction.

EDINBURGH.

Royal Society, March 20.—Dr. J. Horne, president, in the chair.—Dr. C. **Davison**: The Ochil earthquakes of the years 1900–1914. The district chiefly affected lies on the south of the Ochil Hills, and includes Dunblane, Bridge of Allan, Menstrie, Alva, Tillicoultry, and neighbouring places. The earthquakes began in 1900, but did not become frequent until 1905, when ten shocks were felt. There were nineteen in 1906, thirteen in 1907, seventeen in 1908, eighteen in 1909, nineteen in 1910, eight in 1911, seventy-four in 1912, two in 1913, and one in 1914. The total number in the fifteen years was 186. The three earthquakes of September 21, 1905, October 20, 1908, and May 3, 1912, were of unusual strength, and were felt over areas of nearly a thousand square miles. The last of the three was so strong that a slight increase of intensity would have resulted in damage to property. The earthquakes seem to have been due to small movements along the great fault which skirts the southern slope of the Ochil Hills. There was evidence that the origins passed westwards as time progressed. There were indications both of an annual and of a semi-annual periodicity.—Dr. C. G. **Knott**: Mathematical note on the fall of small particles through liquid columns.—W. R. **Smellie**: *Apractoleidus Teretipes*. This Plesiaur was collected from the Oxford Clay by H. N. Leeds, and acquired for the Hunterian Museum by Prof. J. W. Gregory. The major portion of the skeleton is present, the bones being in excellent preservation. In some respects the animal is intermediate between *Cryptocleidus oxoniensis* and *Tricleidus Seeleyi*; but in others it shows a higher degree of organisation than either of these species. For example, in the fore paddle, the humerus resembles that of Cryptocleidus, except in the facets on the distal end; but it articulates with four elements as in Tricleidus. In this way it combines the advantages of both, and gives a broader and more efficient paddle. The shoulder girdle is typically efasmosaurian, and the clavicles are reduced to thin, functionless plates, lying wholly on the visceral surface of the scapulæ. Both pectoral and pelvic girdles show the animal to have been of great breadth. A high degree of ossification is a notable characteristic of the skeleton.

DUBLIN.

Royal Dublin Society, March 28.—Prof. Hugh Ryan in the chair.—Prof. W. **Brown**: The subsidence of torsional oscillations of nickel and iron wires when subjected to the influence of transverse magnetic fields up to 800 c.g.s. units. Experiments on the subsidence of torsional oscillations of nickel and iron wires in transverse magnetic fields, both direct and alternating, up to a maximum of 800 units shows that the damping of the oscillations is increased as compared with the oscillations with no field round the wire. When the frequency of the alternating transverse magnetic field is increased *eight* times, the damping of the torsional oscillations is *decreased* in nickel and *increased* in iron wire.—Prof. W. **Brown**: The change of length in nickel wire due to transverse magnetic fields, direct and alternating. The maximum expansion of nickel wire, due to transverse magnetic fields, both direct and alternating, takes place in a field of about fifty units, the longitudinal load on the wire being 2×10^5 grammes per sq. cm. For higher fields the expansion diminishes gradually, and for a transverse field of about 1000 units there appears to be neither expansion nor contraction.—Prof. Sydney **Young**: The boiling-points and critical temperatures of homologous compounds. The formulæ of Walker, Boggio-Lera, Ramage, Ferguson, and Young are compared, and it is shown that the author's formula gives the best agreement between the calculated and observed boiling-points of the normal paraffins, data for which, including some recently determined in America, are available from CH_4 to $C_{19}H_{40}$. The American chemists have also determined the critical temperatures of normal and *iso*-butane, and the rules regarding the deviations from Guldberg's law, T_c/T_b = constant, brought forward by the author in 1908 ("Stoicheiometry," p. 183), are found to hold good.

PARIS.

Academy of Sciences, April 3.—M. Camille Jordan in the chair.—G. **Bigourdan**: The discovery of the nebula of Orion by Peiresc. This discovery was for a long time attributed to Huyghens (1659), and later to Cysatus (1619). Proof is now given of the observation of this nebula by Peiresc (1610).—Pierre **Duhem**: The conditions which determine electrical movement in a system of several dielectrics.—M. de **Sparre**: The influence of atmospheric conditions on the trajectories of long-range projectiles. For the 40·6 cm. German gun, with a maximum range of 40 kilometres, it is calculated that an increase of temperature of 13° C. or a fall in the atmospheric pressure of 10 mm. causes an increase of range of 1792 metres.—Gaston **Julia**: The reduction of positive quaternary quadratic forms.—Henryk **Arctowski**: The variations of mean heliographic latitude of the sun-spots.—J. **Vallot**: The law which connects the calorific absorption of a cell with the refractive indices of the material of the cell and of the liquid which it contains. The method described in an earlier paper for determining the corrections due to the walls of the cell is applicable to most colourless liquids, but fails for highly viscous or coloured liquids. A method is outlined for dealing with these exceptional cases.—E. **Léger**: The isomeric acetyl derivatives of nataloin and homonataloin.—J. **Chifflot**: The sexual variations of the inflorescences and flowers in cultivated Codiæum.—Mlle. **Trouard-Riolle**: Cross between a wild crucifer and a cultivated crucifer with a tuberised root. The plants used in the experiments were *Raphanus Raphanistrum* and cultivated varieties of *Raphanus sativus*. The tuber formation on the wild plant was readily produced by crossing. The wild type tends to become preponderant in the descendants of the hybrid plants.—Jules **Wolff**: A substance coagulating inulin and accompanying it in plant tissues. This ferment was isolated from chicory roots and from dahlia tubers, and named inulo-coagulase.—Emile **Belot**: The possible origin of terrestrial magnetism.—Ph. **Flajolet**: Perturbations of the magnetic declination at Lyons (Saint-Genis-Laval) during the fourth quarter of 1915.—Marcel **Baudouin**: The early date of the jaw found at La Naulette. From a study of the two premolars the conclusion is drawn that *Homo Naulettensis* dates probably from the Pliocene epoch.—A. **Borissiak**: Indricotherium, a new genus of giant rhinoceros. The

largest representatives of this genus are of greater dimensions than the Mammoth.—E. **Bataillon**: Fecundation membrane and polyspermia in the Batrachians.—Charles **Nicolle** and Ludovic **Blaizot**: The preparation of an experimental antiexanthematic serum and its first applications to the treatment of typhus in man. It has been found that emulsions of the spleen or suprarenal capsules of the guinea-pig can be safely inoculated into horses, and repeated inoculations are possible. In this way the horse and ass have been rendered immune to typhus, and a serum has been prepared applicable to the treatment of the disease in man. Nineteen cases in men were treated and cured.

BOOKS RECEIVED.

Department of Marine and Fisheries. Meteorological Service of Canada. M.S. 51: Upper Air Investigation in Canada. Part i., Observations by Registering Balloons. Pp. 127. (Ottawa: Government Printing Bureau.)

Department of the Interior, Canada. Publications of the Dominion Observatory, Ottawa. Vol. iii., No. 2: Seismological Tables. By Dr. O. Klotz. (Ottawa: Government Printing Bureau.)

Exposition Internationale de Lyon, 1914. La Science à l'Exposition. By Prof. J. Mascart. Pp. 81. (Lyon: P. Legendre et Cie.)

University of California. Publications in American Archæology and Ethnology. Vol. ii., No. 6. Pp. 297–398: The Delineation of the Day-Signs in the Aztec Manuscripts. By T. T. Waterman. (Berkeley, Cal.: University of California Press.)

Journal of the College of Science, Imperial University of Tokyo. Vol. xxxv., Art. 7: Revision of the Japanese Termites. By S. Hozawa. Pp. 161+plates iv. Vol. xxxvi., Art. 7: Contributiones novæ ad Floram Bryophyton Japonicam. By S. Okamura. Pp. 51+tabula xxiv. Vol. xxxvii., Art. 2: Recherches sur les Spectres d'Absorption des ammine-complexes métalliques. I. By Y. Shibata. Pp. 28. (Tokyo: The University.)

Lezioni di Cosmografia: con 20 incisioni nel testo e due tavoli. By Prof. G. Boccardi. Pp. ix+233. (Milano: U. Hoepli.) Lire 3.

Gnomica: L'Orologia Solare a tempo vero nella sua moderna applicazione con 33 incisioni. By G. B. Barzizza. Pp. viii+199. (Milano: U. Hoepli.) Lire 2.50.

Manuring for Higher Crop Production. By Dr. E. J. Russell. Pp. 69. (Cambridge: At the University Press.) 3*s*. net.

The New Public Health. By Prof. H. W. Hill. Pp. x+206. (London: Macmillan and Co., Ltd.) 5*s*. 6*d*. net.

Cerebro-spinal Fever. By Dr. M. Foster and Dr. J. F. Gaskell. Pp. x+222. (Cambridge: At the University Press.) 12*s*. 6*d*. net.

Memoirs of the Geological Survey. Special Reports on the Mineral Resources of Great Britain. Vol. iv.: Fluorspar. By R. G. Carruthers, and others. Pp. iv+38. (London: H.M.S.O.; E. Stanford, Ltd.) 9*d*.

Quarantining Germany. By P. J. Ford. Pp. 16. (Glasgow: J. Maclehose and Sons.) 1*d*.

University of California. Publications in American Archæology and Ethnology. Vol. ii., No. 7. Pp. 399–472. The Mutsun Dialect of Costanoan based on the Vocabulary of de la Cuesta. By J. A. Mason. (Berkeley, Cal.: University of California Press.)

Institut de Paléontologie Humaine. Peintures et Gravures Murales des Cavernes Paléolithiques: La Pileta a Benaojan (Malaga) (Espagne). By l'Abbé H. Breuil, Dr. H. Obermaier, and Col. Willoughby Verner. Pp. 65+plates i–xxii. (Monaco: A. Chéne.)

A Manual on Explosives. By A. R. J. Ramsey and H. C. Weston. Pp. xi+116. (London: G. Routledge and Sons, Ltd.) 1*s*. net.

The Sense of Community. By Sir F. Younghusband. Pp. 25. (London: Williams and Norgate.) 1*s*. net.

A Veteran Naturalist: being the Life and Work of W. B. Tegetmeier. By E. W. Richardson. Pp. xxiv+232. (London: Witherby and Co.) 10*s*. net.

The South African Institute for Medical Research. No. 6: The Trypanosomes of Sleeping Sickness. By G. D. Maynard. Pp. 39+xxvi charts. (Johannesburg: W. E. Horton and Co., Ltd.) 5*s*.

Elementary Strength of Materials. By E. S. Andrews. Pp. viii+216. (London: Chapman and Hall, Ltd.) 4*s*. 6*d*. net.

Spiritualism: a Historical and Critical Sketch. By the Rev. Canon E. McClure. Pp. viii+56. (London: S.P.C.K.) 6*d*. net.

DIARY OF SOCIETIES.

THURSDAY, APRIL 27.

ROYAL SOCIETY OF ARTS, at 4.30.—Scientific Agriculture in India: J. MacKenna.

FRIDAY, APRIL 28.

GEOLOGICAL PHYSICS SOCIETY, at 5.—Presidential Address: Growths in Silica Gel: Prof. Benjamin Moore.

CONTENTS.

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